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The Occurrence of Crust or Scum on Continuous Bottle Tank Furnaces

Suggestions for Its Removal and Prevention

By WILBUR F. BROWN[1]

(*Written for* THE GLASS INDUSTRY)

One of the several causes of serious troubles which periodically arise in the manufacture of lime-flint ware in continuous tanks, has been that of the formation of a crust or scum on the melting chambers of the tanks.[2] This condition may be described as the occurrence of a white, crystalline mass, entirely unfused as regards any glass-making properties, and distinctly separated from the vitreous glass on which it floats. One customarily hears bottle house men refer to it as "a heavy crust or scum clear up to the breast wall."

If we analyze the reason why unconsciously the attribute of heaviness, or more properly thickness, is ascribed to scum, we can find the mental attitude which is usually prevalent with those in charge of furnace operation where scum occurrence is most frequent. The scum does not at first appear in the tank as a heavy surface film. Its formation is gradual. In factories where it gives most trouble, little or no attention is paid to it until it is so far advanced that quality and quantity of output are lowered and gas consumption is increased. By the time serious attention is being given to the undesirable condition in the furnace, enough scum is present to require some knowledge and skill to eliminate it. Scum on a tank is not a matter of a day or two; it often lasts from a week to several weeks, and unless its cause is removed, may persist for longer periods.

Several cases of this kind have been encountered in factories entirely independent as to ownership and management; in each instance a study of the situation showed the same existing conditions. For some time previous to the trouble, the batch used when properly weighed up yielded glass noticeably high in silica content. Using analyses of raw materials as a basis, the composition of soda-lime glasses can be accurately calculated from batch formulæ. The percentage compositions thus calculated for the several glasses under consideration showed that their analyses should have been:

75 to 75.8% Silica
7 to 8% Total Lime[3]
16 to 18.5% Sodium Oxide

with incidental contents of iron oxide and alumina of less than 1%.

As long as correct furnace operation was maintained uninterruptedly the glass melted regularly. It is, of course, not possible to state that scum formation in these tanks was initiated by a cold furnace, but every observation made after its appearance so indicated. It is realized that it is an easy thing to blame unsolved troubles on poor tank operation, but repeated experience has shown that the beginning of scum is preceded by a cold tank. When melting glass containing only 71% to 73% silica and the usual percentages of total lime and soda, it is not likely that the loss of furnace temperature over comparatively short periods will start the formation of scum; but once the melting end gets cold when a high-silica low-lime glass is fusing, scum can be looked for.

It is always desirable from the standpoint of durability to have silica content as high as practicable. High lime also, of course, adds chemical stability, but in practice it is not customary to find total lime content of glass over 8% when automatic or semi-automatic machines are used, and quite often the lime will not total much over 7% to 7½%. It seems to be the consensus of opinion that a large production is lessened where high-lime is used. Now it appears that with ordinary percentages of lime and soda, a silica content of 75% in lime-flint glass is approaching the saturation point. Glasses containing up to 75.7% silica have been successfully melted; sooner or later, however, trouble usually occurs when the silica content is over 75% because the batch is too sensi-

[1]Chief chemist, Libbey-Owens Sheet Glass Company.

[2]Glass workers usually associate the two terms, and it is their common practice to speak of "crust or scum" rather than to use one of the words alone. Either term properly conveys the meaning.

[3]By total lime content of glass is here meant the sum of calcium and magnesium oxides.

tive to changes in fire conditions. Under the average bottle furnace teaser, cold tanks will occasionally happen. With silica content near saturation point, a cold furnace results in uneven fluxing of batch ingredients, and unfused patches begin to appear floating down the furnace. If at this stage the furnace man would recognize the danger signals, and pull back the unfused islands, the scum trouble would not advance very far. In actual practice it is rare to find such a procedure; it is more common to have the melting end of the tank half covered with scum before much notice is taken of it.

A second cause for formation of scum is that of low-lime content in the batch. This condition occurs less frequently with limestone than with burnt lime batches, for here again applies the oft repeated fact that instead of burnt lime containing its usual average of 95% total lime, its strength is considerably below normal. Another not infrequent cause of lime deficiency is that of incorrect weighing due either to carelessness or to defective scales. For some reason, lime seems to be slighted by batch-mixers more than any other ingredient they handle. As a matter of fact what is given as the second reason for scum really amounts to the same as the first cause ascribed, viz.; that of too high silica for proper batch fluxing except under ideal conditions; for naturally when the average lime content of glass is decreased by a per cent or more, the silica content correspondingly rises. If the silica content is already near the saturation point, an increase of ½% to 1% will noticeably affect correct batch action in the furnace.

Perhaps some will object to the expression of a silica "saturation" point for bottle glasses. The term may not be strictly scientific, nevertheless it fits the case from the viewpoint of a chemist when he is called on to make recommendations for avoidance of scum. Many analyses have invariably shown scum on bottle tanks to consist of high silica, medium soda, and low lime. It is sometimes difficult to convince the factory manager or superintendent that scum contains considerable soda, while at the same time it is very deficient in lime, compared with glass. Unless confidence has before been established between the analyst and the factory, reports on scum are liable to be disbelieved by the man actually in charge of tank operation. The reason this statement is made is because quite recently a case of scum on tanks was encountered where the superintendent ordered a wheelbarrow full of soda ash put on each batch fill at the dog house. This particular man had a glass chemist available for the asking, but instead of seeking for facts, he preferred to use the old-time supposed remedy of shoveling in soda ash to flux the scum. In passing it may be remarked that the place to add anything to the batch ingredients is in the mixing room; if something must be added at the dog house when scum occurs, lime would help, but soda ash would not. Another point which perhaps makes it difficult for some to believe that scum consists of silica and soda with relatively low lime, is that sodium silicate or water glass fuses at quite a low temperature. This idea was once brought out by a young glass chemist when the subject of scum was under discussion. It need only be stated that the percentage of soda in water glass is several times that always encountered in the crust which appears on bottle tanks. In cases where scum has covered a large area of the melting chamber, it lies on the glass as a blanket and acts as if it is infusible at ordinary furnace temperatures. Fire cannot properly reach the glass underneath; even an appreciable increase in temperature does not cut off the crust. Scum once well developed remains comparatively inactive; one can move areas of several square yards about the furnace simply by inserting a poker point in the blanket. Sometimes it is possible to burn off the scum by heating up the furnace very hot over a week end; but unless the batch has been properly balanced this procedure is at best only a temporary remedy.

Specific recommendations for the removal—and naturally also the prevention—of scum are:—

First: Be sure that the batch formula yields a glass not too high in silica.

Second: See that the batch scales are accurate, and that the mixer uses due diligence in weighing.

Third: Take all precautions possible to maintain a high temperature in the melting end of the tank, particularly where the melting should be done—which is in the back of the furnace, and not down at the last port.

Borax, fluorspar and arsenic all have their advocates when it comes to adding material to batch for removing scum. We emphasize again that a properly balanced batch is the only logical and correct method of being assured that scum troubles will not arise; and when they do arise the first move which should be made is to ascertain that a full amount of lime is being put into the glass.

In concluding, it is stated that while perhaps there may be other causes for scum than those herein ascribed therefor, the conclusions arrived at in this article are made from actual occurrence in three independent factories. Exactly the same conditions encountered five years ago in one place have recently come to notice in another factory, the latter being in many respects the equal of any bottle house in operation today.

Analyses of scum will, of course, vary within certain limits. The following is an example which shows about as high lime content as has been found in scum:

Silica	81.26%
Iron oxide and alumina	0.38%
Total lime	4.78%
Sodium oxide	14.11%

The following table is an excellent example of a typical case. The scum blanket, which was about one inch thick, persisted for weeks. Samples were easily obtained free from the underlying clear glass, and care was exercised to select them midway between the side walls and beyond the last port:

	Analysis of Glass Calculated from Batch Formula	Analysis of Scum
Silica	75.73%	88.43%
Iron oxide and alumina	0.60	.37
Total lime	7.84	2.86
Sodium oxide	15.85	8.48
Total	100.02%	100.14%

The Production Report

A Successful System of Recording Production Data, Described by a Cost Accountant of Many Years Glass Factory Experience

By E. L. KRAUSS[1]

(*Written for* THE GLASS INDUSTRY)

The knowledge and information that can be derived from a properly planned and compiled production report is wide and varied. It is the purpose of this article, however, to deal with it in only a few of its most important points in relation to the glass factory making a specialty of pressed ware.

The production report when properly compiled will give much valuable information in regard to the operation of the factory. The outline of such a report, which is in successful operation in a number of glass factories, is submitted in this article for its readers.

The production report in this case is made up from the shop payroll sheets which are drawn up in special form to show the "good made" and various "losses" according to their kind, and for each kind of ware made by each individual shop. From this record is made up a work sheet showing the number of good pieces made of each kind of ware and the hours consumed in making them. After the good production in pieces is obtained the weight of good production is figured by multiplying the total good pieces of each kind of ware by the average weight per piece. Care must be taken in arriving at the average weight of the articles made, test

Form No. 4. Turn Followers

(Front)

FORM NO. 4.

19503 Turn No. C 1 — Pressed Dept. — Shop No. 3 — Date 11-7-20

Clock No.	NAME	Occupation	HOURS
	Olson	Presser	8
	Barber	Gatherer	8
		Turner-Out	
		Carrier-In	
		Carrier Over	
		Sub-Presser	
		Sub-Gatherer	
		Sub-Turner-Out	
		Sub-Carrier-In	
		Sub-Carrier Over	
Tumbler No.		Pcs. Made	
Tumbler No.		Pcs. Made	

19503 Sorting Card — Turn No. C 1 — Shop No. 3 — Date 11-7-20 — Tumbler No. 1046

Clock No	NAME OF SORTERS	Time Started	Time Finished	Total
	Marcus	12 00	1 00	1

Presser	Olson
Lehr Lehr	1
No. Pieces Presser is Paid for	1600
" Bad (Not Paid for)	48
" Made	1648
" Good	1600

TIME TAKEN MUST BE ENTERED ON THIS CARD

(Back)

DETAIL COST

Date Figured		Expense Base			
Ware Made	1046				
Hours Worked	8				
Lehr Space	1				
Pcs. Good	1600	133⅓	00		
" Seconds					
" Bad	48				
" Total	1648				
Wt. Each Oz.	1				
Total Wt. Oz.	1648				

DESIGNATION

Metal Cost	#	1	65			
Lehr "		1	00			
M. G. R. "						
G. H. "						
Total Material		2	65			
Prod. Labor						
Furnace Room		3	00			
Sorting			40			
Trucking			10			
Burden			20			
Total Prod Labor		3	70			
Bdn. Furnace Rm.		10	00			
Total Cost		16	35			
Avg. Cost per Doz.		.12	26			

Strained		Sand Blast	
Heavy			
Stuck	1	Lehr. Melted	
Not Full	8	M. G. R. M.	
Crizaled	4	Packed	1600
Pressed Up		Paid for	1600
Cracked Bot.		Bad	48
Pinched		Total	1648
Crooked Bot.		Scored	
Sucked			
Blisters			
Cracked	25		
Chipped	10		
Broke			
Total Bad	48		

One of these forms is filled out, front and back, for each turn of ware made and the various losses are written on the back of the sorter's card. The Shop Payroll is made up from these Turn Followers, showing the pieces made, good, and the various losses as indicated by the cards.

[1]Cost Manager, Federal Glass Company.

weights being taken from time to time to check up the averages to determine their accuracy. A still more accurate way is to weigh each turn of finished ware as it goes through.

filled. To the net batch add the total weight of cullet filled in, which will give the total weight of metal used in the period.

Form No. 86

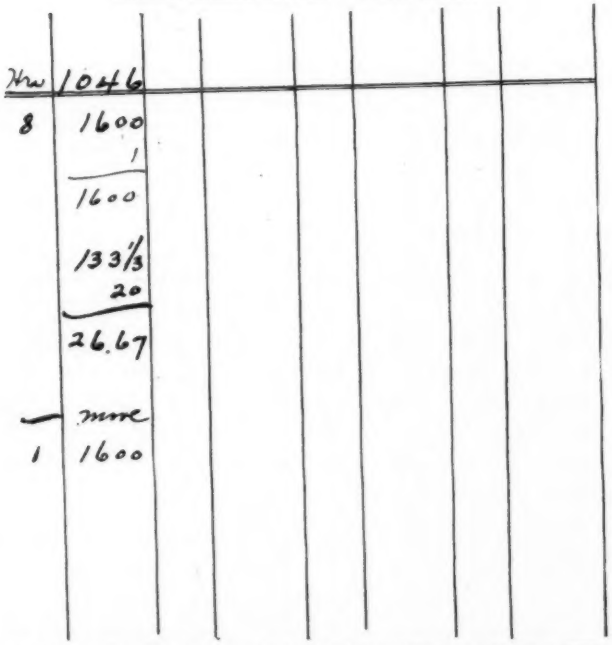
PRESS SHOPS Factory No. 5

	TOTAL MADE	Cracked	Chipped	Blistered on Edge	Cracked on Edge	Crizzled	Heavy Bottom	Cracked Bottom	STUCK	Cracked Feet	Crooked	Not Full	IRON	Smooth Inside	Misfits	Pressed up	Good off	M. G. M.	Blisters	Seconds
	1648	20	10		5	4			1			8								

THIS IS THE SHOP PAYROLL FORM ON WHICH IS POSTED THE RECORD OF

Having the weight and production of good pieces we are now ready for the next step, which is to determine the amount of net metal melted for the same period of time as that in which the production was taken. This is done by taking the

Blank Ruled Form. Work Sheet



THIS IS THE WORK SHEET FORM ON WHICH IS MADE UP THE HOURS WORKED AND THE GOOD PRODUCTION IN PIECES. THE AVERAGE MOVES, TOTAL WEIGHT OF GOOD PRODUCTION AND SELLING VALUE ARE FIGURED. THE PRODUCTION SHEET, FORM NO. 105, IS MADE UP FROM THIS WORK SHEET.

total weight of materials used in the batch and reducing them by a previously determined percentage to cover loss due to volatilization. For illustration, say fifteen per cent of the batch filled is lost in fumes through melting, this would leave a net batch melted of eight-five per cent of the weight

From the total weight of metal used take the total weight of good production and the remainder will be the weight of cullet produced in excess of filled, if the weight of product is less than the weight of material filled. If the weight of product is more than the filled weight the indication is that more cullet has been used than produced.

To illustrate:

Batch Filled .....
Less 15% Volatilization .....
Net Batch Melted .....
Plus Cullet Used .....
Total Metal Melted .....
Less Weight Good Production .....
Cullet Produced .....(debit or credit)

If the cullet is not weighed as filled the illustration will take this form:

Batch Filled .....
Less 15% Volatilization .....
Net Batch Melted .....
Less Weight Good Production .....
Cullet Produced .....(debit or credit)

If the weight of good production is more than the net batch melted the difference is the weight of cullet used and this amount should be charged to material used and cullet stock account credited. If the weight of good production is less than the total metal melted the difference is the weight of cullet produced in excess of filled and this amount should be credited to material used and cullet stock account charged.

If flow sheets have been previously estimated for the factory the above information will check them up to a very accurate degree.

Having listed the hours consumed in making the good production it is an easy matter to reduce them to turns worked. After reducing the hours to turns the average good per turn can be determined by dividing the production of each article by the turns. This information will be found of great value in figuring costs on which to base selling prices. It is advisable to post these average moves on separate move cards for each kind of ware made, each period they are fig-

ured; this will give an accurate and permanent record from which grand averages can be figured for any length of time desired for cost figuring.

Good and Bad Production made by Shops
Week Ending———————

Shop No.	1	2	3	4	5	6	Total

Shop Payroll

Night Shift C Date 11-13-20 Shop No. 3

Production Price	GOOD	Piece Work price per 100	PAID FOR	Vacuum	KIND OF WARE	Turn No.	PRESSERS	GATHERERS	
	1600		1600		1046		Olson	Gerber	8 hrs

PRODUCTION AS SHOWN BY THE TURN FOLLOWERS AND FROM WHICH THE SHOP PAYROLL IS FIGURED.

This record of average moves can be figured by shops if it is desirable to do so. This information would be of great value to the factory manager in having his shops working on the articles they produce best when possible to do so. This will be a source of increased production and quality and lower cost as can be readily seen.

If a record of production is kept in the above manner and reports of the various losses, as shown by the shop payroll sheet, are given to the department managers at regular intervals, both in pieces and percentage of total, they will no doubt be able to introduce methods for reducing the losses to a minimum and thus increase the production to some extent.

Much other valuable information can be obtained by compiling the production report in this way but the limited space of these pages will not permit of so lengthy a discussion.

The factory manager's report of losses, good and made production is made up in typewritten form and is taken from the shop payroll form. This report is made up as indicated in the following form, a convenient arrangement for making comparisons and other purposes.

Name of Ware
Total Ware Made
Total Ware Good
Total Ware Bad
Percent Bad
Turns Worked
Average Good per Turn

The report of percentage bad of the various losses is also made in typewritten form and is taken direct from the shop payroll form and is made as follows:

Shop No.	1	2	3	4	5	6	Total
Total Made							
Lehr Melts							
" " %							
Strains							
" %							
Etc.							
" %							
Total Losses							
" " %							

In these times of high costs and limited production it behooves the manufacturer to look well to his losses and do all he can to reduce them to a minimum, for therein lies one of the few chances of reducing costs and increasing profits.

Form No. 105. Production Sheet

FORM No. 185

PRODUCTION SHEET

SHEET No. 1

WEEK ENDING 11-13-20

WARE Pressed TANK No. 5 ENTERED BY 15

ARTICLE	Wt. Each in Ounces	PIECES	Total Weight in Ounces	Gross or Dozens	Price	AMOUNT
1046	1	1600	1600	133⅓	20	26.67

THIS IS THE FORM ON WHICH IS MADE UP THE PRODUCTION REPORT IN ITS FINAL FORM.

Use of Light Soda Ash in the Production of Flint Bottle Glass

By C. A. COLE[1]

(*Written for* THE GLASS INDUSTRY)

During the recent freight congestion certain flint bottle manufacturers were unable to procure sufficient dense soda ash for the maintenance of their glass tanks at normal production. In order that there should be no interruption in their operation, it was suggested that light soda ash be used as a substitute for the dense ash. This suggestion was made in view of the fact that in Europe and especially on the Continent, there are many glass manufacturers who have had very great success in the production of flint bottle glass and even of the finer grades of glass, with the use of the so-called light soda ash of commerce.

These bottle glass manufacturers were persuaded to introduce light soda ash into their glass batches, and in many cases a complete substitution for the dense ash was made.

The success with which the use of the light ash was attended in certain of these plants, was much greater than was anticipated by the glass manufacturers, especially in the shorter tanks, where it was thought the length would not permit of sufficient time for the refining process.

After an operating period extending over several months, it has been satisfactorily demonstrated to the glass manufacturer that on certain types of glass tanks, a very satisfactory ware may be obtained, either by machine or hand operation. This success was very largely due to the use of maximum temperatures together with a change in method of charging the tanks which required small charges at frequent intervals, as contrasted with the charging of large quantities at longer periods.

CHARACTERISTICS OF LIGHT AND DENSE ASH

Chemically, the composition of the light and dense soda ash of commerce, is identical. Physically, as is well known, the apparent density of the so-called dense ash is much greater than that of the ordinary product. The relative bulk of these products is about as follows:

As made by different producers the light soda ash weighs per cu. ft. from 31 to 34½ pounds, while the dense soda ash per cu. ft. weighs 60 to 67 pounds; their melting points are the same, approximately 815°C.

OBJECTIONS TO THE USE OF LIGHT SODA ASH

Due to the fact that a very large part of the alkali used in the United States for glass manufacture is being received in bulk at the glass plants, any tendency to extra dust is regarded as of serious objection by the glass man. For this reason the glass manufacturer has been opposed to the use of this lighter product. While it is true that the lighter ash may be somewhat more dusty than the denser product, it does not necessarily follow that the dense ash may not be dusty. This objection to dust may be very largely eliminated in the near future when the pneumatic unloading machines, which are now being perfected, are adapted efficiently for the unloading of bulk alkali.

The extra bulk of the light ash necessitates a greater volume to handle and accordingly requires a larger storage as compared with the same weight of the dense material.

This extra volume of the lighter product compels extra handling in the batch house and consequently requires a greater capacity in their conveying apparatus and charging bins; also for a part of the time in the tank, the batch may occupy a greater volume than would be occupied by an equal amount of alkali in the form of the dense material.

The glass manufacturer has pointed out further alleged defects in the use of the light product which, in view of our recent experience, do not appear to be well sustained, when certain types of tanks are considered.

The operator of glass tanks objects to the light ash on the ground that he is unable to maintain the maximum production of his tank. He ascribes this loss of production to the behavior of this light ash in his batch, which he claims causes a separation of its constituent parts and which necessitates a slowing up of the operation in order to provide sufficient time for the batch to melt and become thoroughly refined before it is withdrawn at the shop end of the furnace.

In addition to this supposed defect in the use of the light product, it is the general impression of the glass man, that there is a certain loss of alkali in the various parts of his plant. It is claimed that a loss is sustained in the handling of this material from the cars up to the point of the batch's introduction into the glass tank, and that there is an additional loss through the blowing of the lighter particles out through the tank and into the stack of the furnace.

Much information concerning these real and alleged defects in the use of light soda ash in glass tanks for flint bottle glass manufacture was obtained in several months' operation, an account of which follows.

DESCRIPTION OF TANKS

The substitution of the light for the dense product was carried on at two plants which will be known as plants "A" and "B".

PLANT "A".—At this plant there were three tanks in run, known as No. 2, No. 4 and No. 7.

No. 2 tank—Was running on white bottle glass, this tank having the following characteristics:

Age	8 months
Size of tank	13′ 1″ x 18′ 3″
Size of nose	8′ 2″ x 18′ 3″
Depth of glass	3 feet
Tonnage	Output per 24 hours, 10 to 12 tons
Machines used	Cox type No. 11, machine and hand blown

This tank was fired by fuel oil.

No. 4 tank—Was working on green bottle glass and had the following characteristics:

[1]Solvay Process Company.

Age	8 months
Size of tank	19′ 6″ x 14′ 1″
Size of nose	19′ 10″ x 11′ 0″
Depth of glass	3 feet
Tonnage	Output per 24 hours, 12 to 15 tons
Machines used	Cox type No. 11, machine and hand blown

The heat on this tank was maintained by the combination of firing, which consisted of Pennsylvania slack coal, with a booster of crude oil.

No. 7 tank—Was working on amber glass and had the following characteristics:

Age	8 months
Size of tank	9′ 2″ x 9′ 8″
Size of nose	9′ 6″ x 7′ 2″
Depth of glass	3 feet
Tonnage	Output per 24 hours, 8 to 11 tons
Machines used	Cox type No. 11, machine and hand blown

All of the tanks at plant "A" were fed by hand at approximately two-hour intervals.

PLANT "B"—At this plant the light ash product was used in a tank of the following characteristics:

Age	8 months
Size of tank	14′ x 32′
Size of nose	12′ x 14′
Depth of glass	3 feet
Machines used	Cox type

This was working on white bottle glass and was fed by hopper at intervals of 20 to 30 minutes.

HISTORY OF THE USE OF LIGHT ASH IN THE ABOVE TANKS

Freight congestion had compelled the substitution of light soda ash for the dense product at these plants when the tanks were approximately 7 to 8 months old. At plant "A" the tanks were in fair condition, while at plant "B" the tank in run was considered to be in very good condition.

At the time the change was made, the following formula was being used in connection with the dense product:

Sand	1,000 lbs.
Soda Ash	360 "
Lime	110 "
Salt Cake	3 "
Color	—

When the change was made, to the lighter material, the soda ash was increased 40 pounds, making the new batch as follows:

Sand	1,000 lbs.
Soda Ash	400 "
Lime	110 "
Salt Cake	3 "
Color	—

After using the light ash in the above formula for three weeks, it was discovered that all tanks were accumulating a scum, which is frequently seen on tanks in this country. Also that the glass was running very seedy, with occasional stones, and that production was dropping, in some cases the tanks going as low as 75% of their former yield.

At plant "A" there was no system for determining the temperature, either occasionally or by means of recording apparatus. The superintendent in charge believed that his tanks were running between 2,200 and 2,400° F, but had not verified this by actual measurement. At plant "B" the tank in operation was fitted with recording thermometer, which indicated an average temperature of 2,275° F.

The method of feeding at two-hour intervals at plant "A" necessitated the charging of a very large quantity of batch in order to maintain the tank at proper production. In so doing the temperature of the tank was materially lowered so that it was only at the end of the two-hour interval that the tank was in proper condition for the correct melting of its batch. At plant "B" while the temperature was not as high as is generally required for the proper fusion of this kind of a batch, the frequent feeding and the extra length of tank permitted the use of this lower temperature and the tank yielded a quality of glass much superior to that from the shorter tanks at plant "A", although it was not entirely free from seeds.

TEMPERATURES

At plant "A" temperature measurements were carefully made of the feed end and nose end of each tank and the following averages found:

	Tanks No. 2	Tanks No. 4	Tanks No. 7
Feed End	2350°F	2275°F	2400°F
Nose End	2150	2085	2120

These temperatures are much too low for the proper fusion of a batch of the composition given.

At plant "B" the following temperatures were recorded at the feed and nose end with a Leeds and Northrup Optical Pyrometer:

	Tank No. 3
Feed End	2275°F
Nose End	2020°F

These temperatures also indicate a lower heat than is usually regarded as sufficient for this type of fusion.

It was suggested that these temperatures were much too low for the proper working of these tanks and that the minimum be raised so as to maintain a heat between 2,400 and 2,500° F.

ANALYSES OF BATCH CONSTITUENTS AND RESULTING GLASS

After the increase of temperature on all tanks, samples of the various batch constituents were taken, together with specimens of so-called clear and seedy glass, and analysed with the following results:

Analysis of Soda Ash

Sodium Carbonate	96.79
Sodium Bicarbonate	None

Analysis of Lime

Calcium Oxide	50.21
Magnesium Oxide	34.37
Carbon Dioxide	3.3
Water	10.98

Analysis of Sand

Moisture approx. 5%
Balance Silica (by inspection)

ANALYSES OF BATCH SAMPLES "A" AND "B" PLANTS

Plant "A" Samples		(1)	(2)	(3)
Soda Ash	Na_2CO_3	24.25	23.32	24.12
Calcium Oxide	CaO	4.84	3.58	3.70
Magnesium Oxide	MgO	3.09	2.05	2.29
Silica	SiO_2	60.75	65.27	64.06

Plant "B" Sample

Soda Ash	27.43
Calcium Oxide	4.18
Magnesium Oxide	2.67
Silica	61.24

SIFTING TEST ON AVERAGE BATCH SAMPLES AT PLANT "A"

	(1)	(2)	(3)
Retained on 30 mesh	8.1%	10.0%	7.5%
" " 40 "	6.9	7.7	6.6
" " 60 "	40.8	41.7	43.5
" " 80 "	13.9	13.9	13.6
" " 100 "	8.9	8.0	8.4
" " 200 "	14.0	13.6	16.2
Through 200 "	7.4	5.1	4.2
	100.0%	100.0%	100.0%

The analysis of the soda ash entering the batch would indicate that the total alkali was about 2% lower than the material as shipped from the soda ash manufacturer, this decrease in alkali being accounted for by the method of storing. The bulk material, under certain atmospheric conditions, will absorb water and carbon dioxide. The strength in this case, however, had not been sufficiently impaired as to affect the fusion of the batch.

An inspection of the lime analysis representing the material as used at plants "A" and "B" showed that the inert material, that is, carbon dioxide and moisture, approximated 14%. On this basis only 86% of the lime charged would be available for glass manufacture. That is, of the 111 pounds used per batch, only 95 pounds of lime were actually available. For this reason an increase of 10 pounds of lime was recommended.

In addition to the low actual lime content, it will be further noted that this lime was of dolomitic origin and contained approximately 34% of magnesium oxide. Lime containing magnesium oxide in excess of 25% has been considered by some authorities as tending to make the resulting glass more viscous than the ordinary straight "calcium" lime. For this reason it was urged that the feed end, as well as the draw end of the furnace, be maintained at maximum temperatures. It was thought that maximum temperatures would increase the fluidity of the glass as it advanced towards the draw end of the tank, and that this increase in fluidity would prevent the retention of any gas particles due to secondary reaction between carbonate of soda and silica in the shop end of the tank.

The sand appeared to be satisfactory for this type of glass, being fairly good color, not too fine or containing an unreasonable amount of large particles. This was further confirmed by the sifting test of the batch samples.

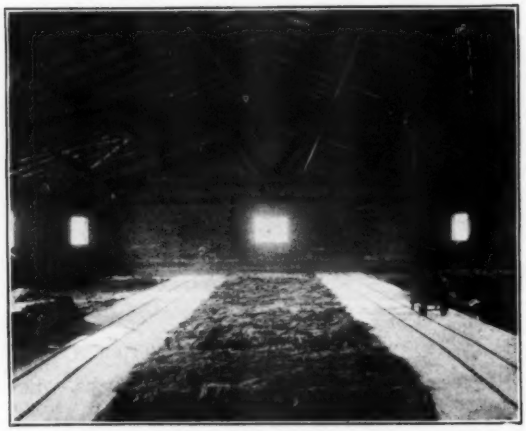
Analysis of the various batch samples at each plant showed a general uniformity in the mixing of the various constituents. These analyses also indicated that the ingredients were being used according to the formulas described at each plant, which were identical.

CHECKING UP BATCH BY ACTUAL ANALYSIS

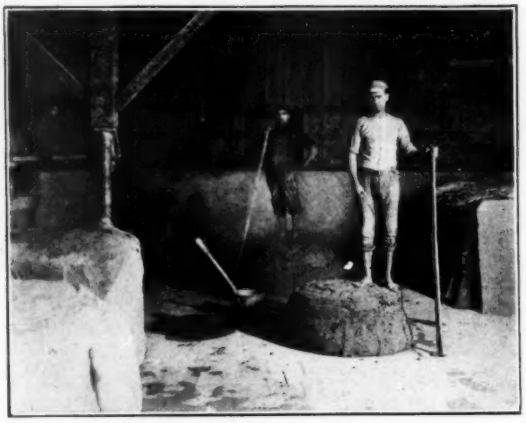
The batch formula calculated to a percentage basis would be as follows:

The Art of

Illustrations From a Paper by Chas. O. Grafton,[2] Published

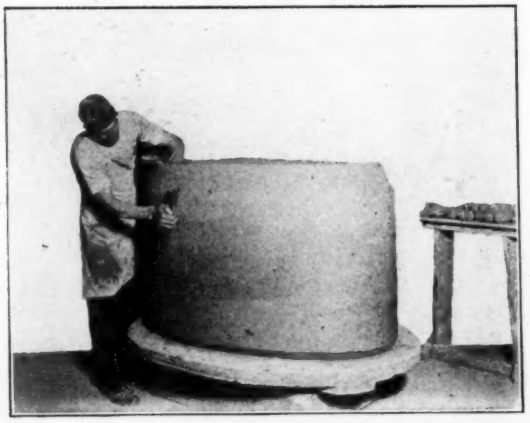


1. AGEING PITS



2. TRAMPING CLAY

5. WORKING FINGER COURSES



6. SHOULDER WORKING

[1] Jl. Am. Cer. Soc., Vol. 3, No. 8 (August, 1920), pp. 653-662. Engravings reprinted by courtesy of the Editor.

[2] General Manager, Gill Clay Pot Company.

		Percentage Basis
Sand	1000 lbs.	66.1
Soda Ash...	400 lbs.	26.4
Lime	111 lbs.	7.5
Total.....	1511 lbs.	100.0

Calculating the batch from actual analysis, making correction for moisture, the following result was obtained:

Sand	67.7
Soda Ash	24.6
Lime	7.6

A comparison of the above calculated analysis and the actual determination, show that while there is not an exact agreement between these two sets of figures, the actual analysis of the batch indicates that they were running fairly close to their standard formula. This analysis is probably as close as can be obtained when taking into consideration the difficulty experienced in sampling a batch made up of these materials.

ANALYSES OF FINISHED GLASS AT PLANTS "A" AND "B"

	Plant "A"	Plant "B"	
	Clear	Seedy	Seedy
SiO_2	72.74	72.76	73.66
CaO	4.82	4.88	4.80
MgO	2.59	2.42	3.82
Na_2O	16.43	16.28	16.20

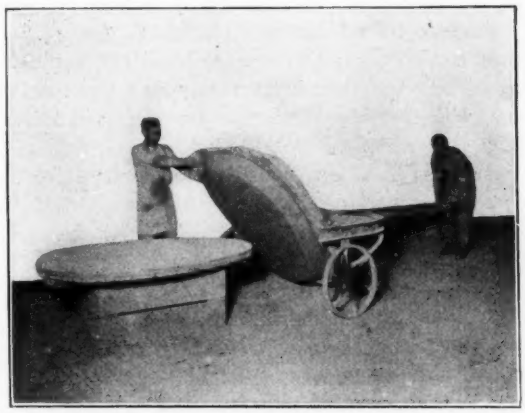
These analyses show practically no difference between the clear and so-called seedy glass. Such results have been experienced before in previous investigations where seedy and stony glass were the complaint. These analyses point out that as far as the chemical composition of the glass was concerned, there was no essential difference and that it might be properly concluded that the seedy glass was the result of drawing the glass from the shop end of the tank before the reaction products had had time to escape from the molten glass. The tendency to retain these gas particles in the shop end of the tank was probably further emphasized by the presence of a dolomitic lime in the batch, the supposed effect of magnesium oxide in glass batches of this character tending to a greater viscosity with resultant retention of glass particles which later form the seeds noted in the finished ware.

These glass analyses show that a very uniform product was being manufactured at each plant. The average analysis of actual glass at the above plants was as follows:

SiO_2	73.05
Na_2O	16.3
MgO and CaO	7.77

Pot Making[1]

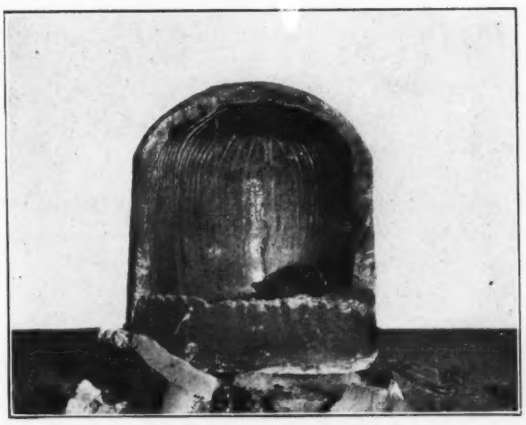
in the Journal of the American Ceramic Society



3. TURNING THE BOTTOM OF A GLASS POT

4. WORKING HAND COURSES

7. BEATING DOWN CROWN



6. POT AFTER FIFTY-ONE WEEKS' USE

LOSS OF SODA ASH IN TANKS

If we calculate from their standard batch formula the resulting glass, we should have as follows:

SiO_2	74.3
Na_2O	18.
MgO and CaO	7.4

A comparison of these last two analyses shows that while the actual silica and magnesium oxide and calcium oxide are very close to the calculated content, there is a difference of total alkali (Na_2O) of 1.7%. This would indicate a loss of alkali equivalent to 3% of soda ash.

On the other hand, if we consider the materials going to the tank as being represented by the actual analysis of the batch, the loss of soda ash indicated is reduced to zero.

Sand	67.7%
Soda Ash	24.6
Lime	7.6

Making correction for inert material (moisture and carbon dioxide) in the batch, we should have:

Sand	67.7 x 95%	= 64.31 lbs.
Soda Ash	24.6 x 56.6%	= 13.92 lbs.
Lime	7.6 x 85.7%	= 6.51 lbs.

After fusion this batch should yield:

As Batch		As Glass	
64.31 lbs. Silica =		SiO_2	75.89%
13.92 lbs. Alkali =		Na_2O	16.43
6.51 lbs. Lime =		MgO & CaO	7.68
			100.00

Then comparing actual glass analysis and glass from actual batch analysis, we have:

	Actual Glass	Glass Calculated from Batch Analysis
SiO_2	73.05	75.89
Na_2O	16.30	16.43
MgO & CaO	7.77	7.68

It will be noted that the resulting glass calculated from the analysis of the batch compares very closely with the average analysis of glass at each plant. These analyses would indicate practically the same (Na_2O) alkali content, showing that there was no loss of alkali.

It is probable that the analysis representing the batch going to these tanks is perhaps a more accurate statement of the batch's composition, and on this basis it may be concluded that the loss of alkali was practically nil in these operations as far as the actual tank operation was concerned.

MAXIMUM TEMPERATURE AND UNIFORM FEED REQUIRED IN USING LIGHT ASH

A review of the temperatures maintained at these various tank furnaces together with the method of feeding, and the excess of soda ash used over the old formula when dense ash was used, indicated that the following causes were contributing largely to the low production and seedy glass at these plants.

Insufficient heat was undoubtedly the primary cause of the original trouble at these plants, as the temperature records of these tanks show a lower heat than is generally considered necessary for the complete fusion of this type of glass.

As is well known, when the heat of such tanks drops below 2,200° F, there is a tendency for incomplete fusion, resulting in an undue separation of the batch, with the subsequent appearance of scum on the surface of the tank, together with seed and stones in the ware.

Combined with this lack of heat, it was further determined that the manner of charging these tanks also affected the temperature. The practice of charging these tanks in large quantities lowered the temperature below the proper fusion point. By raising the minimum temperature to a point between 2,400 to 2,500° F and changing the manner of charging from large quantities at long intervals to very much smaller quantities at 20 to 30 minute periods, the tendency to a scum formation and the related seeds was practically overcome.

CONCLUSIONS

Our investigations concerning the substitution of light soda ash for dense in the manufacture of bottle glass from these tanks pointed out the following difficulties:

Unless maximum temperatures and uniform methods of feeding are observed, there is a tendency for the accumulation of scum, with the subsequent appearance of so-called seeds and stones in the glass at the shop end. It is probable that these seeds are the result of a separation of the batch during the first part of the melting operation. This separation produces a stratification of high alkali glass on the top and a high silica glass on the bottom of the tank. This high silica glass eventually separates itself into small particles, some of which do not fuse and appear at the surface as scum and insoluble stones. It is also probable that the high alkali glass on the top of the tank, not always having sufficient silica to react with it before it goes through the shop end, undergoes a second reaction at this point, causing a further decomposition of soda with a subsequent liberation of gas particles in the molten glass.

However, it is possible to eliminate a very large part of this scum formation and the subsequent seed in the glass, provided maximum temperatures are observed. This is especially true if the glass tanks are of sufficient length, approximately the type used at plant "B" in this investigation. It is suggested that a temperature of 2,450° F is not too high when running with the light soda ash, and that the shop end should be maintained as hot as is consistent with good quality. The sand should be kept as wet as is consistent with good working conditions. In the mixing of the batch it is recommended that the period be extended to insure a perfect coating of sand particles with lime and soda.

In charging the batch it is urged to avoid any tendency to form an uneven mass on the surface of the molten glass. The charge should be spread as it is fed to the furnace. In connection with the feed, it is desirable to have hopper fed tanks on account of the ease and frequency at which small charges may be made to the tanks.

In general it is recommended that any part of the glass works operation that will secure a more perfect mixture of the batch and a more uniform feeding to the tank, together with the maintenance of maximum temperatures, will very greatly assist in a more perfect melting of the light ash with the other constituents of the batch, and therefore yield a more uniform product at the shop end of the tank.

Selenium

From a Note Book

By CHESTER L. SHARP[1]

Success in any business depends to a large extent on up-to-date information. For this reason, the men interested in glass are using note books more and more every day. Almost every glass manufacturer has used selenium in some form. For this reason, I feel he might be interested in a few selenium notes from my note book.

Selenium was formerly considered a rare metal, and was discovered by Berzilius in 1807. It occurs in minerals, and is found with sulphur in some pyrites and in copper and gold ores. The first selenium placed on the market commercially was extracted from Scandinavian sulphur deposits. Later, selenium was also discovered in other ores.

Selenium itself is odorless and tasteless, but the vapor possesses a distinct and disagreeable odor. It burns with a reddish-blue flame.

Selenium as a coloring medium for glass was patented by F. Welz in 1891. He was the first to use selenium or a mixture of selenium and cadmium sulphide for the production of rose and red-colored glasses. In 1893, a second German patent was issued to Dr. Spitzer of Vienna for the coloring of glass with selenium compounds.

These discoveries were of particular importance inasmuch as the red color derived in glass in the use of selenium, acts to compensate physically the green cast in glass, due to presence of iron in the silica. A superior method was thereby secured for the physical decolorization, for which manganese was principally employed hitherto, the use of which dates back to times of early antiquity. It is of course, well known that manganese strikes back after being exposed to the action of light, for long periods, resulting in a violet color in the glass.

The idea that selenium could be used for coloring glass, probably arose from the fact that it has been known for a long time that glass can be colored with sulphur, which is closely related to selenium. The colors which can be obtained with sulphur cover all shades between a light yellow and a black brown, and it has not as yet been definitely decided whether the color results from the presence of elementary sulphur or from polysulphides. It is likely that the coloring is derived from both; sulphur giving the yellow tints and the very dark browns arising from the polysulphides or from colloidal iron sulphate.

Very small quantities of selenium suffice to give glass a rose color. Irrespective of how much selenium may be added, the color cannot be increased beyond a definite limit. It has been estimated from German experimental work that lime glass will not under any circumstances take up more than 0.06% metallic selenium. Lead glass, however, will take up increased quantities, but owing to the formation of selenide of lead, a black brown color will be produced in the glass. The close analogy between sulphur and selenium is here again readily perceived. Selenium compounds are unquestionably the cheapest as well as the most efficient means for physical decolorizing in the production of pure white glass.

It is a well known fact that various materials in this elementary state are recognized means for coloring glass, in particular gold and silver, and it must therefore appear likely that the rose color given by selenium is also due to a colloidal suspension of this element in the glass body. This point has been thoroughly investigated in the past few years and in particular by the Italian chemist, Fenaroli, who has sent various articles on the subject to technical journals abroad.

German authorities claim that potash glasses give the finest rose colorings with selenium, also that the larger the quantity of chemical bases contained in the batch, the more the color tends to a brownish tint. If this claim can be accepted as correct, the larger the proportion of silica that can be worked in the batch, the more desirable will be the rose color achieved. It is further claimed in Germany that if soda is used in place of potash, the color will suffer accordingly. It is very questionable, however, whether this claim can be taken as altogether accurate.

(*Translated from Sprechsaal*). "New color gradations are made possible by combinations of selenium or selenium compounds with gold, as also with silver and all metal oxides, those used for coloring as well as the decolorizers, and further in combination with other decolorizing minerals to the extent to which they give off acids and consequently oxidize the selenium to selenium dioxide. The selenium coloring, according to my experience, is considerably retarded or entirely prevented, even when metallic selenium is embodied with the glass batch, when a bright clean flame is employed, as it readily dissolves in the molten metal without producing any marked coloring, and undoubtedly is converted into an oxide by the attraction of acids, principally the dioxide, and presumably is thus maintained in the glass in a colloidal form. A reducing agent is therefore first required if an elementary separation of the selenium is to be accomplished, and it then produces the coloring of the amorphous selenium, in consequence of which the glass is tinted red. Colloidal solutions of selenium were first obtained by Hans Schultze by the reduction of neutral, greatly diluted solutions of selenium dioxide, with a pre-determined amount of sulphur dioxide, which produced a red fluid which was fluorescent in direct light. I believe that the result obtained by Schultze also prevails in the selenium-colored red glasses. Instead of the sulphur dioxide, the principal reducing agent used for glasses is the arsenious acid. Inasmuch as this requires oxygen for greater oxidation, it diverts the two atoms of oxygen from the selenium dioxide, at the same time liberating the red elementary selenium. This result, however, would ensue when melting with a reducing flame."

In discussing selenium compounds, another writer in *Sprechsaal* states: "These compounds are more constant at high temperatures than the metallic selenium, which soon vaporizes and carbonizes in the glass furnace."

[1] President, The Sharp-Schurtz Company.

This can easily be understood because the melting point of amorphous selenium is approximately 50 deg. C. and the crystalline form 217-219 deg. It has been shown that amorphous selenium becomes noticeably volatile at 120 deg. C. A new selenium chemical compound recently developed by D. D. Schurtz[1], becomes volatile above 700 deg. C. The higher the volatile point, the greater the length of time the decolorizer stays with the batch, or the raw material. The superiority of a high volatile material as a decolorant is very clearly indicated.[2]

Although the application of selenium as a coloring medium for glass was patented about twenty-nine years ago, there is today but very little published on the subject of selenium glass.

The Devitrification of Glass[3]

Translated for THE GLASS INDUSTRY

By HARRISON W. CRAVER

If molten glass is subjected to slow cooling, a change occurs in it. This change is usually visible. White spots appear in the glass, these extend outwards like rays in all directions, the glass becomes turbid, and after a time the previously clear glass becomes changed into an opaque mass resembling porcelain, the so-called Reaumer porcelain. This occurrence is known as the devitrification of the glass. It frequently occurs during the working out of the glass mass from the pots. The glass becomes "raw," the workers say, and in this case there is nothing better to do than to stop operations and give the furnace a strong heat again. If a piece of window-glass is permitted to lie in a flattening furnace, at a temperature sufficient to keep the glass permanently soft, an exactly similar change will be observed when it is taken out and permitted to cool; from which it appears that the ordinary flattening-furnace temperature is entirely sufficient to produce these phenomena. In this case the turbidity begins on the upper surface of the glass and progresses gradually and uniformly to the center. The turbidity then commences on the lower surface also and comes toward the upper surface in similar fashion. If the process is interrupted at this moment, three different layers can be observed on the fractured surface, which is milk-white and opaque above and below, and clear and transparent in the center. At the same time it will be perceived that the cohesion between the individual layers is quite weak, so that they can easily be separated from one another. This devitrification or clouding results from the physical phenomenon of crystallization of the glass. If the initial white point, which looks like a grain of sand, is examined with a microscope, a large white core is seen, around which extend feathery crystal structures, fine as hair and usually hexagonal. The turbid porcelain-like glass obtained in this way may be used for making various wares. Analysis of the crystallized and amorphous batches has shown, through further investigations, that 100 parts of the crystallized glass contain 76 parts silica, 1.01 alumina, 0.57 ferric oxide, 0.41 magnesia, 0.33 manganous oxide, 7.15 potash, 7.77 soda and 2.02 sulphur. It is also further established that glass high in lime devitrifies very easily. According to observations that have been made on the exact composition of such a product, the comparison is as follows:

	Clear Batch	Crystallized Portion
Silica	64.7	68.2
Alumina	3.5	4.9
Lime	12.0	12.0
Soda	19.8	14.9

REMARKS BY THE GLASS INDUSTRY REVIEWER

The literal translation from *Diamant* touches a subject of timely interest to many American manufacturers. As is often the case, the reviewer must bear in mind that conditions in foreign manufacture are often not analogous to those encountered in the quantity production prevalent in our own practice. It is a coincidence that the paper dealing with devitrification of glass came in from our translators just after the contribution appearing in this issue concerning tank scum was finished. We are inclined to believe that the author of the *Diamant* article has confused scum with devitrification. As usually encountered, crust or scum strongly resembles porcelain, while in devitrified glass the crystalline structure may or may not extend throughout the entire body. Under the microscope, devitrified glass shows much interstitial vitreous glass; scum appears to be completely crystallized.

Some research work has been done in America on this subject as it relates to tank glasses, but it is not now available for publication. We can, however, state that every analysis which has been made on devitrified glass has shown that the composition of the devitrified masses is exactly the same as that of the surrounding region of amorphous glass. In a private communication to the reviewer, it has been pointed out by one of our American petrologists that the index of the separated crystals differs from that of the interstitial glass, and that undoubtedly a different chemical composition would be found if it were possible to separate the tiny individual crystals from the glass. Thus far the separation has not been accomplished. To all ordinary appearances, devitrified tank glass is wholly opaque. A good many analyses have been made by the reviewer on personally selected samples of devitrified glass from both bottle and window tanks, and there has been found no variation from the general conclusion that devitrified glasses are of exactly the same composition as the body of glass from which crystallization has occurred.

Discussion of this subject will be welcomed either as brief notes or in the form of separate articles.

The question is an important one to manufacturers, and consequently has its practical aspect. It goes almost without saying that it offers an interesting field to scientists.—W. F. B.

[1] The Sharp-Schurtz Company.

[2] We quote an interesting correlative statement from the Journal of the American Ceramic Society, 2, 897 (1919)—THE EDITOR:
"Metallic selenium melts at 217° and boils at 675°, forming a red-yellow vapor. Hence it escapes readily from the batch during the melting and fining periods and it is necessary that the pot door be sufficiently covered with wet clay to prevent the escape of the coloring agent. If any fumes at all are observed to escape, it is known that some of the selenium is being driven out of the glass. After the selenium becomes incorporated with the glass, probably in colloidal suspension, it is retained permanently, provided the temperature is not raised above 1,400°."
{ 700° C. = 1,292° F. }
{ 1,400° C. = 2,552° F. }

[3] Diamant, July 21, 1920, vol. 42, p. 379.

Selenium a Rare Element

Selenium is described by the United States Geological Survey as a little-known element, having its greatest use in giving a red color to glass, such as that used on railroads for signal lights, and in coloring enameled ware red. It is also used to overcome the natural green color of ordinary glass.

Lubrication of Air Compressors[1]

By H. V. CONRAD
Practice Recommended by the Compressed Air Society.

Satisfactory lubrication of air compressor cylinders is attained by securing (1) the reduction of friction to a minimum and (2) elimination of carbonization of the oil as far as possible.

For the proper reduction of friction, the oil chosen should have sufficient body to sustain the weight of the moving parts and to form a seal between the piston rings and the cylinder walls, and still not absorb excessive power in the overcoming of the viscosity of the oil itself.

The objections to air cylinder oils which allow more than the very slight amount of carbonization which appears unavoidable, are, of course, well known, but may be briefly stated for the purpose of clarifying what follows:

Carbonization of the oil allows the accumulation of deposits of carbon, which are sticky in the early stages of their formation but hard and flinty later. Such deposits accumulate on the cylinder valves, in the cylinder passages, in the pipes and eventually in the air receiver.

Sticking or partial closing of the valves and their consequent failure to act properly is probably the chief objection to this action from the standpoint of the efficient operation of the compressor.

The formation of excessive carbon deposits is apt to be due to any one or more of the following causes:

1. The ill-advised use of some oil, such as a steam cylinder oil, which easily decomposes in the heat of the air cylinder.

2. The use of oils of toc great a viscosity—commonly referred to as "too heavy oils." These do not atomize readily and, therefore, remain too long upon the hot cylinder walls, etc., thus baking down to stickly carbon deposits.

3. The use of too great quantities of oil, which has the same effect as the use of too heavy an oil as far as the carbonization is concerned.

4. The failure to provide a proper screen over the air intake of the compressor, thus allowing free entrance of dangerous dust (especially coal dust).

The objections to this carbonization aside from the sticking of air valves and choking of the air passages is the menace of fire entailed by carbon deposits. Carbon particles torn loose from them may become incandescent from causes which could not be anticipated by the compressor manufacturer. If such incandescent carbon particles should happen to come in contact with "oil vapor" given off by the lubricating oil, a fire might possibly be started whose menace would be small or large depending upon how much carbon had been allowed to accumulate in the compressor and piping to the receiver. If these are kept properly cleansed at all times, there should never be a time of any danger.

This oil vapor is given off from a lubricating oil at a certain temperature called its "flash point" just as steam arises from water at a certain point.

[1] Copyrighted, 1919, by the Compressed Air Society.

Heat of Air Compression

The selection of an air cylinder lubricant is, of course, governed to a considerable extent by a knowledge of cylinder temperature it must withstand. Knowing the air pressures, the corresponding temperatures are ascertained fairly accurately, as shown in Table No. 1.

This table gives the final temperature in the cylinder at the end of the compression stroke, for single stage, also for two stage (or compound) compression, when the free air entering the cylinder is 60 degrees F.

Table No. 1—Cylinder Temperatures at End of Piston Stroke.

Air Compressed to	Final Temperature Single Stage	Final Temperature Two Stage
10 lbs. gauge	145 degrees F.	.....
20 lbs. gauge	207 degrees F.	.....
30 lbs. gauge	255 degrees F.	.....
40 lbs. gauge	302 degrees F.	.....
50 lbs gauge	339 degrees F.	188 degrees F.
60 lbs. gauge	375 degrees F.	203 degrees F.
70 lbs. gauge	405 degrees F.	214 degrees F.
80 lbs. gauge	432 degrees F.	224 degrees F.
90 lbs. gauge	459 degrees F.	234 degrees F.
100 lbs. gauge	485 degrees F.	243 degrees F.
110 lbs. gauge	507 degrees F.	250 degrees F.
120 lbs. gauge	529 degrees F.	257 degrees F.
130 lbs. gauge	550 degrees F.	265 degrees F.
140 lbs. gauge	570 degrees F.	272 degrees F.
150 lbs. gauge	589 degrees F.	279 degrees F.
200 lbs. gauge	672 degrees F.	309 degrees F.
250 lbs. gauge	749 degrees F.	331 degrees F.

Variations from these temperatures will occur in actual practice due to water jacketed air cylinders and radiation, tending to lower the temperature at the higher pressures. But at, say, 50 pounds pressure and lower, the heat is likely to be somewhat greater than given by the table, particularly if the compressor is run at high speed and also if it is not water jacketed.

Relation of Oil Flash Point to Cylinder Temperature

The natural inference of the reader after noting the temperatures in Table 1, is that he must select an air cylinder oil whose flash point is higher than the maximum temperature apt to be encountered within the air cylinder. As a matter of fact, this is not the case and it need only be carefully noted that: the study of the air cylinder temperatures is useful mainly in testing lubricating oils to determine their resistance against breaking down into carbon, etc. But such temperatures cannot be taken as limits establishing the highest allowable flash point for a lubricant safe to use in the air cylinders.

Qualities of Cylinder Lubricating Oils

For average normal conditions, the oil should be a medium bodied pure mineral oil of the highest quality, not compounded with fixed oils such as animal or vegetable, and should be carefully filtered in the final process of manufacture.

Quite a range of oil composition is permissible for lubricants approved for this work, which are manufactured under the above conditions. Primarily a distinction must be made between those oils having a paraffin base as distinguished from those having an asphaltic base.

From a strictly operating standpoint—so it is claimed by some lubricant manufacturers—there is no distinction between these two classes of lubricants as to their desirability as compressor cylinder oils, provided that both have been properly filtered in the process of manufacture to remove the carbon forming elements. If any carbon should be formed, however, such carbon deposited by the asphaltic base oils is of a light fluffy nature and easily cleaned out, whereas, that deposited by the paraffin base oil is very adhesive, and characterized by the hard, flinty nature.

PARAFFIN-BASE LUBRICATING OILS

Merely as a guide to aid the operator in specifying the qualities to be possessed by an air cylinder lubricant recommended for average duty, the following table is presented:

TABLE NO. 2—PHYSICAL TESTS OF PARAFFIN BASE OILS.

	Minimum	Average	Maximum
Gravity, Baume	28 to 32 deg.	25 to 30 deg.	25 to 27 deg.
Flash point, open cup.	375 to 400 deg. F.	400 to 425 deg. F.	425 to 500 deg. F.
Fire	425 to 450 deg. F.	450 to 475 deg. F.	475 to 575 deg. F.
Viscosity (Saybolt) at 100 deg. F.....	120 to 180 sec.	230 to 315 sec.	to 1500 sec.
Color	Yellowish	Reddish	Dark Red to Green
Congealing point (pour test deg. F.).....	20 to 25 deg. F.	30 deg. F.	35 to 45 deg. F.

It is suggested that those oils within the range expressed by the minimum figures be used for light duty of low-pressure and temperatures, while those expressed by maximum figures should be used for high pressures and temperatures.

It is recommended that any paraffin base lubricant intended for use in "all standard air compressors," should meet the physical tests imposed by the average range of figures given in the middle column of the above table. The above wording "standard air compressors" is to be interpreted as including the following types of machines:

a Low pressure up to 100 lb. compressors, which may be either small sized single stage units, or larger sized compound machines.

b High pressure compressors which are constructed with the proper number of stages so that no excessive temperatures are ever reached.

In other words, this lubricant of average test figures is always recommended unless a compressor manufacturer specifies in his literature that a high flash point oil should be used to meet the conditions peculiar to his machine. It is thus obvious that it is never necessary that a lubricant should possess a flash point as high as 500 degrees unless abnormal conditions of high temperature prevail. Such high flash point oils have an unusual tendency to produce carbon deposits.

ASPHALTIC BASE LUBRICATING OILS

This group of oils is considered separately for the reason that the lower limit of gravity stated in the above table, viz., 25 deg. Baume, eliminates this entire group from consideration—which is not the intention of this article.

As a guide for the selection of suitable oil, the following table is given:

TABLE NO. 3—PHYSICAL TESTS OF ASPHALTIC BASE OILS.

	Minimum	Average	Maximum
Gravity, Baume	20-22 deg. F.	19.8-21 deg. F.	19.5-20.5 deg. F.
Flash point, open cup.....	305-325 deg. F.	315-335 deg. F.	330-375 deg. F.
Fire	360-380 deg. F.	370-400 deg. F.	385-440 deg. F.
Viscosity (Saybolt) at 100 deg. F.	175-225 sec.	275-325 sec.	475-750 sec.
Color	Pale Yellow	Pale Yellow	Pale Yellow
Congealing point (pour test)..	0 deg. F.	—0 deg. F.	—0 deg. F.

For general all around use, it is conceded that the recommendations given in Tables No. 2 and No. 3 above cover the situation as well as possible, special cases, of course, requiring investigation and special consideration before making recommendations.

PROPER QUANTITY OF LUBRICATING OILS

The quantity of lubricating oil to feed to the air cylinders of compressors cannot be stated in exact terms due to the varying viscosity of different oils, the heat of compression and the size of cylinder. It may be stated in general, however, that after the cylinders have acquired smooth and polished surfaces, the quantity should be reduced to the lowest limit to avoid the possibility of the accumulation of carbon and sooty deposits within the system due to excessive use.

The following basis of quantity given in Table No. 4 is recommended, subject to above modifications for these cylinders or equivalent sizes, operating under normal conditions.

TABLE NO. 4—QUANTITY OF AIR CYLINDER LUBRICANT REQUIRED PER 10 HOUR DAY.

Diameter of Cylinder, Inches	Size of Cylinder, Inches	Displacement Per Minute Cubic Feet	Piston Speed Feet Per Minute	Sq. Ft. of Cylinder Wall Swept by Piston	Drops Oil Per Minute	Drops Oil Per 10 Hrs.	Sq. Ft. Oiled Per Drop.	Number Pints Oil Required Per 10 Hrs.
8	8x 8	120	344	718	1	600	718	.0375
12	12x12	320	408	1,230	2	1,200	613	.0750
18	18x18	880	496	2,340	4	2,400	585	.1500
24	24x24	1,730	550	3,450	6	3,600	575	.2250
30	30x30	2,940	600	4,700	8	4,800	590	.3000
36	36x36	4,550	644	6,070	10	6,000	607	.3750
42	42x42	6,700	696	7,600	12	7,200	633	.4500

Figures of last column are based upon an estimated 16,000 drops per pint of oil at 75 degrees Fahr.

It will, of course, be carefully noted and clearly understood that the results in the last column of Table No. 4 are based upon the assumption that under average conditions of temperature and usual range of oil viscosities, a pint of oil will contain an average of about 16,000 drops. It is of course understood that these figures are offered merely as an approximate guide and that every individual must exercise his own judgment in modifying them wherever his own particular set of working conditions is unusual.

A leading authority on compressor engineering contributes the following: "The best way to determine the proper amount of lubrication is to take out the valves from time to time and examine the cylinder. All parts should feel that there is oil thereon. If they feel dry, the lubricators should be adjusted to feed a little more oil, whereas if oil lies in the cylinder and its parts show excessive oil thereon, the quantity fed by the lubricators should be reduced. By thus examining the machine a few times, the proper amount of oil can be determined to suit the characteristics of the particular lubricant used and the conditions under which the machine operates." This is a better way to finally determine the quantity of oil required than by adopting without this experimenting any tabulated number of drops.

PERIODICAL CLEANSING OF SYSTEM

The best of lubricating oils will cause the deposit of enough carbon in the compressor system to necessitate the periodical cleansing of it.

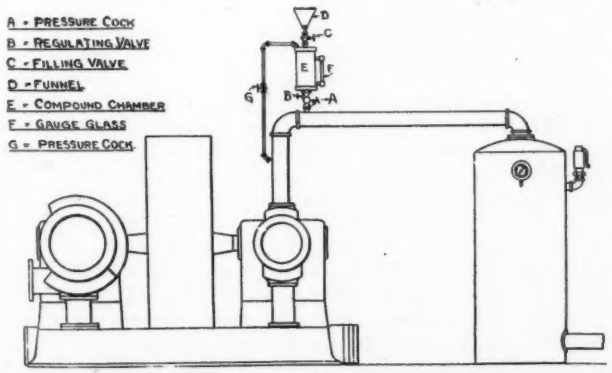
For the removal of carbon, the machine operator should confine his efforts to the use of soap suds. A good cleansing

solution is made of one part soft soap to fifteen parts water. These suds should take the place of oil for a few hours, and be fed into the air cylinders about once a week, either by means of a hand pump or through the regular lubricator at a rate about ten times as rapidly as that of the oil. The cleanliness of the air valves when inspected, as they should be periodically, will indicate whether greater or lesser applications of the soap suds should be made. After using soap suds, open the drain cock of the air receiver, and of the intercooler in the case of compound machines to draw off any accumulated liquid. Oil should be used again for a half hour before shutting down the machine in order to prevent rusting the cylinder and its fittings. Never use kerosene, gasoline or lighter oils in an air cylinder for any purpose whatever, because of their volatile nature under heated conditions.

OBSERVATIONS ON CHANGING TESTED OILS

When the operator of an air compressor succeeds in obtaining lubricating oils that are giving satisfactory results, he should be very cautious about making a change to other grades, particularly if cheapening the cost is advocated by purchasing and sales agents. But if a change is decided on, the performance of the new lubricants should be most carefully checked up before damage can occur to the rubbing surfaces of the compressor, and to see that no increased amount of deposit collect on the inside walls of the air receiver.

The most satisfactory way to get the quickest results is to put up the problem of lubrication to the local experts of any reputable lubricating companies, and to be governed by their recommendations, which, however, should be based on the foregoing statement.



DEVICE FOR CLEANING CARBON IN AIR DISCHARGE LINE AND RECEIVER OF AIR COMPRESSORS.

Compound:—Mix 1 lb. of Red Seal lye to 18 lb. of water. To use compound: Close cock "A" and "G," open valve "C" and fill compound through funnel "D"; when chamber "E" is filled close valve "C," open cock "G" and "A" and regulate feed by valve "B"; use about 70 drops per minute.

CLEANING AIR RECEIVER AND PIPING

It often happens that oil, carbon and other foreign matters are deposited in the air discharge lines and air receiver. A practical method of cleaning these is shown in cut attached, where a receptacle made of 6-inch pipe is shown set on top of the discharge pipe. The cut shows plainly the construction and what the different parts represent. If a mixture of one pound of Red Seal Lye and eighteen pounds of water is passed into the discharge line at the rate of 60 or 70 drops per minute, while the compressor is running, this will eat out all the accumulation on the surface of the pipe and in the receiver, and if the blow-off valve on receiver is open, all of this foreign matter will be discharged therefrom. This cleaning solution can be used every month or two or depending on how much accumulation there may be in the receiver.

STEAM CYLINDER LUBRICATION

The proper quantity of oil to be fed to steam cylinders is much greater than to air cylinders due to the constant washing away of the oil by the steam. Approximately four times as much oil will be needed in the steam cylinders as in those for air, subject, of course, to variable local conditions.

Depending on its viscosity, a pint of steam cylinder oil will furnish from 5,000 to 8,000 drops, and taking an average of about 6,500 drops, and four times as much oil as air cylinders of same size, and working at same piston speeds, as given in Table No. 3, the recommended amounts to feed the steam cylinders or their equivalents are given in the following.

TABLE NO. 5—QUANTITY OF OIL FOR STEAM CYLINDER LUBRICATION.

No. Drops Per Minute	Size of Cylinder Inches	Number Pints Oil Required Per 10 Hours
4	8x 8	.4
8	12x12	.75
16	18x18	1.5
24	24x24	2.25
32	30x30	3.0
40	36x36	3.75
48	42x42	4.5

These figures are approximate only, and will vary with the steam conditions, the kind of oil used, and its method of introduction into the steam, also with the boiler compound carried by the steam into the cylinder.

Plenty of Soda Ash for Everybody!

An inspection trip over the new provincially owned Pacific Great Eastern Railway, which runs through the heart of British Columbia as far as the fifty-third parallel, has taken me 320 miles north of Howe Sound, or 400 miles from Vancouver, but this is only a small part of the distance which this railway will cover when it is completed. Ultimately the Pacific Great Eastern will connect with the railways of Alaska. It is the object of the Government to communicate with the Yukon by means of Canadian operated and owned railways.

Lakes of soda are being discovered along this new track. There is every promise that the sodium carbonate yield will eclipse all records once it has been sufficiently developed. A lake sixty acres in extent, less than two miles from the main line, was found to contain on expert analysis not less than 7 per cent. pure sodium carbonate. An Eastern concern will construct a plant before next Spring, and soon after the snow is gone shipping will be begun.

Other non-metallic minerals, such as dolomite, gypsum, gypsite and epsom salts are found in this same neighborhood. Sodium carbonate is used in the manufacture of soap, paper and glass, besides being a very popular medicant. It is easily recovered from the lakes, as every cubic foot of water contains more than four pounds of it. A magnesite deposit has been discovered and will probably be developed. Magnesite is used in making fire-brick and in blast furnace operations.—*Cornelius Vanderbilt, Jr., special correspondent, in the New York Times.*

Safe Storage of Coal

Useful Information for the Many Glass Factories Now Using Coal for the Production of Fuel Gas as Well as in Steam Power Plants

So many inquiries reach the Bureau of Mines, Department of the Interior, concerning the spontaneous combustion of coal that the Bureau has issued the following general statement on the subject.

The point of view of the Bureau is as follows relative to the technical matter of spontaneous combustion: The wisdom of establishing large storage piles is, of course, another matter which must be determined from the facts in each case.

The conditions of storage of coal are so various as to make it necessary to apply general principles in each case rather than specific directions.

It is to be recommended that coal should be stored in small quantities as near to the point of consumption as possible. Small coal piles rarely ignite from spontaneous combustion. Coal should be stored near the point of use to avoid rehandling, extra transportation, and the degradation of size which follows each rehandling. For these reasons the Bureau would advocate storage, so far as possible, in the bins and yards of the ultimate consumer, thus dividing the risk of loss from spontaneous combustion. If large storage piles are necessary, certain general principles must be borne in mind. The generation of heat is the result of slow oxidation of the coal surface. The oxidation is much more rapid from freshly mined coal or from freshly broken surfaces. The oxidation rate increases rapidly with increased temperature. Different coals have different oxidizing rates. These facts lead to the following recommendations:

Where there is choice of coal to be stored, that having the lowest oxidizing rate should be chosen, if known.

Between two coals, that which is least friable, and therefore which presents the least total coal surface in the pile, should be selected.

The method of handling should be such as to produce the least freshly broken coal surface.

The coal should be as cool as possible when piled. Piling warm coal on a hot day is more likely to produce spontaneous combustion.

The coal must be kept from any extraneous source of heat.

Alternate wetting and drying of coal during piling is to be avoided if possible.

The fine coal, or slack, which furnishes the larger coal surface in the pile, is the part from which spontaneous combustion is to be expected. Piling of lump coal where possible is therefore desirable.

In the process of handling, if the lump coal can be stored and the fine coal removed and used immediately, the practice prevents spontaneous combustion in coals which would have otherwise given trouble.

The sulphur content of coal is believed by many to play an important role in spontaneous combustion. The evidence on this point is still conflicting, but to play safe, it is desirable to choose coal having a lower sulphur content, when choice is possible.

There is a current belief that dissimilar coals stored in one pile are more liable to spontaneous combustion. The evidence on this point is also conflicting, but to play safe, it is advisable to store only one kind of coal in a pile.

The ground on which a coal pile is built should be dry.

The foregoing recommendations are all derived from the factors affecting the heating of coal.

There should be no spontaneous combustion, whatever the heating rate, provided the heat is carried away as rapidly as produced. This fact brings about the following recommendations:

Coal piles should be so made that there is ready movement of air for ventilation throughout all parts of the coal pile. This is the condition when the entire pile is made of coarse lump coal. With ordinary coal piling this is difficult.

The surfaces of coal piles should be so exposed as to allow the pile to cool; or else the coal should be so stored that air circulation within the pile is very small. When the air circulation is reduced to a minimum, as in an air-tight bin with no opening in the bottom, the oxygen of the air is soon removed and the mass of the coal lies in an inert atmosphere, except for small local circulation near the surface. Air-tight bins are usually impracticable, but the following practice is recommended to approximate these conditions:

In making a coal pile of mixed sizes, the coal should be so handled as to make a homogeneous pile and prevent the segregation of coarse and fine coal. This frequently determines the most desirable machinery for unloading coal.

It is common practice to limit the height of a coal pile, this for two reasons: A pile too high crushes the lower layers of coal, producing more fines; the larger the pile the less heat-dissipating surface there is exposed in proportion to the heat generating capacity of the pile. Twelve feet in height is a common limit.

Whatever precautions are taken in choice and handling of coal, provision should be made for keeping track of the temperature rise in a coal pile and for rapid rehandling of portions of a pile in case of excessive heating. In a coal pile covering a considerable area, it should be so subdivided that in case of spontaneous combustion of a portion, the heat will not be transmitted to the whole pile, thus accelerating the heating of portions of the pile which normally would have remained cool.

To keep track of the temperature of coal piles, it is recommended that half-inch iron pipe be driven vertically into the pile at distance of fifteen or twenty feet apart. A maximum thermometer lowered into the pipe to varying depths will indicate the temperature of the pile opposite the thermometer.

A survey of the pile and a survey of the temperature of all parts of the pile should be made twice a week during the first three months after the pile is made, and once a week thereafter until the pile has evidently ceased to heat. As soon as any portion of the pile reaches a temperature of 150 degrees, provision should be made for removing that portion of the pile. Actual removal need not begin until the temperature has reached 180 degrees, but at these temperatures the rate of oxidation is dangerously rapid. The object of rehandling the coal is to allow it to cool below a dangerous temperature. Any method of rehandling which does not allow of cooling will only transfer the difficulty from the old pile to the new one. It is usually useless to employ water in an attempt to cool a coal pile.

Lack of provision for rapid reloading, cooling, and repiling of coal is the cause of serious loss from spontaneous combustion.

Loss of Heating Value in Stored Coal

A new device, called the coalometer, developed jointly by Prof. A. W. Browne, Professor of Chemistry at Cornell University, and R. P. Nichols, has been designed to detect heat losses in soft coal piles due to slow combustion below the surface. Describing the conditions which the invention has been designed to meet, Mr. Nichols says:[1]

"Could the consumer look beneath the surface of his coal pile and definitely acquaint himself with conditions existing there, he could save himself enormous losses by using that part of his coal supply first which showed a tendency to become even slightly heated."

[1] *Scientific American*, Vol. CXXII, No. 22 (November 27, 1920), pp. 539.

The Situation of the German Glass Industry

American Manufacturers Need Have Little Fear of Intensive Competition From Germany for a Long Time to Come

By C. A. HEISE[1]

(*Written for* THE GLASS INDUSTRY)

Among the various German industries that have developed to an extraordinary extent during the last 20 years, the glass industry ranks conspicuously. While in 1897 the industry gave employment to nearly 65,000 workers, the 1913 figures showed an increase of 40 per cent. and the discrepancy between export and import is strikingly illustrated by the following table:

	IMPORT.	
		Value in 1,000 marks
1897	15,000 tons	11,242
1907	15,230 "	15,198
1913	16,750 "	17,131
	EXPORT.	
1897	113,215 tons	43,516
1907	174,500 "	115,338
1913	241,940 "	146,124

This shows that export had increased from 1897 to 1913 by approximately 110 per cent. and the value of the exported goods by approximately 235 per cent. The total production of glass and glassware in 1897 was nearly 516,150 tons, valued at 115,215,000 marks. No exact figures are available for 1914 and the following years of the war, but it is fairly safe to assume that the total production before the war was approximately 984,350 tons, representing a value of 450 to 500 million marks.

The above figures clearly indicate that the German glass industry was first and foremost an export industry. The outbreak of the war, however, in conjunction with the blockade, shattered all her hopes of capturing foreign markets and it will be a long, long while before the industry will have recovered from that shock.

With the outbreak of the war, export came to a standstill with the result that many works had to close down. Soon, however, the demand of the home market increased. Bottles, jars, and glasses used for the preservation of fruit and all kinds of foodstuffs were eagerly asked for, as were medical appliances, optical goods, and as a substitute for metal, glass was used for various purposes; while as regards glass for the lighting industry, the works catering specially for that line could hardly cope with the orders.

The luxury glass industry was well supplied with foreign orders, which is hardly surprising in view of the fact that, in the absence of competition, neutral buyers had to place orders with German firms. With regard to the plate, window and wire glass industry, the conditions in this line were not favorable even before the war on account of the then prevailing stagnation in the building industry and the war rendered the situation even more precarious in spite of the elimination of the Belgian competition and increased orders from neutral countries.

SHORTAGE OF MATERIALS

Some of the lines severely hit through the exigencies of the war were the lighting-glass, thermometer, and pipe industries, all of which were chiefly catering to the export trade. Although the demand for German glassware was steadily increasing in neutral countries, there were many conditions that rendered a full exploitation of this opportunity impossible. One of the greatest drawbacks, which affected the industry to a great extent, was the shortage of soda, most of which was commandeered by the ministry of munitions with the result that the industry had to fall back upon substitutes, such as sulphate, and, later on, carbonate of potassium, while finally even these became so scarce as to render the industry almost dependent upon old material.

The utilization of sulphate was at first connected with considerable difficulties which were, however, eventually overcome. The dearth of coal was a more serious affair. Many works had to close down on account of the coal famine and had to be compensated by voluntary contributions of the industry, the distribution of the funds being in the hands of special compensation boards organized by the industry. Towards the end of the war some lines were unable to maintain their former output, the result being a scarcity of certain kinds of goods so that the Government prohibited export of such articles.

Soon after the armistice, most of the works which had been closed by order of the Government on account of lack of raw materials, coal, etc., prepared for restarting operations in anticipation of increased supplies of coal, but the revolution and the loss of important coal mining districts under the terms of the peace treaty soon disillusioned those who hoped for a speedy revival of the industry.

The supply of coal is of vital interest to the German glass industry. If Upper Silesia should be lost to Germany, the loss of the coal fields in that district is not considered to be of grave consequence inasmuch as few glass works were dependent upon the Silesian coal. Of greater importance, however, is the loss of the coal supplies from the Saar district and from Czecho-Slovakia, the Bavarian glass industry being especially dependent upon coal from the last named country, while the Saxon glass industry has already succeeded in adapting itself to the brown-coal delivered from coal fields situated in Central Germany. Generally speaking, the most important competitor of Germany during the coming years will undoubtedly be Czecho-Slovakia, the industry of which country has greatly developed during and since the war, thanks to the wideawake trade policy of their government, which is furthering the industry with all means. Extension of plants and erection of new works form the outstanding feature of the present activity of the glass industry in Czecho-Slovakia and the German industry will have to fight hard to hold its own against this formidable competitor, not to forget the Belgian, English, American, French and Japanese competition. Belgian and French competition is especially feared with regard to the window-glass and hollow glass line as well as luxury glass and lighting glass.

The most important question for the German glass trade, apart from the coal supplies, is the reestablishment of international trade relations and the recovering of their lost markets. German glass manufacturers openly acknowledge that the latter will be a most difficult task and the possibility of having to look around for new markets forms one of the topics of conversation in interested quarters.

South and Central America are generally considered the future markets for the German glass export trade and German manufacturers will make strong efforts to establish themselves in those territories as soon as the German industry is once more in a position to export on a large scale. At present, sales both abroad and at home are lagging on account of the enormous rise in the cost of labor and raw material on the one hand and the improvement of the German exchange on the other, but these features are looked upon as temporary ones by the German manufacturers who hold that they will gradually disappear, thus enabling the industry to gradually resume large scale production.

[1] Assistant Secretary, American Association of Commerce and Trade, Berlin.

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NEW YORK, DECEMBER, 1920

Reducing the Hazards of the Glass Business

The glass manufacturer does not need to be reminded that his business involves a larger than ordinary share of the risks incident to manufacturing operations in all lines, besides some special hazards peculiar to the nature of the industry. He knows, from hard earned experience, more than any one can tell him of the effects of unforeseen and unfavorable happenings upon his profit and loss account. Particularly, the executive directly responsible for keeping up production has found, especially during the past year, that life is anything but "a continual round of pleasure." Pestered by conditions beyond his control resulting from embargoes, car shortages, fuel famines, blizzards and other inflictions, he has been, at times, hard pressed to obtain adequate quantities of sand, soda ash, salt cake, gas, coal and other necessities for maintaining even fairly normal production.

The average executive usually depends upon his own experienced judgment, inventiveness and common sense to overcome emergency situations. Some problems, such, for instance, as priority car orders, (discussed by R. E. Riley in our November number) require collective action on the part of the manufacturers. In one way or another the average factory manages to "muddle" through emergencies and, under favorable selling conditions, to show a profit at the end of the year. It may not be impertinent, however, to make inquiry as to whether manufacturers are doing all they can to avoid losses due to preventable accidents or other causes.

The frequent instances brought to our attention of partial or total destruction of glasshouses by fire, is a case in point. Most fires are preventable; proper equipment, proper methods, a properly instructed factory personnel and strict enforcement of safety regulations will practically eliminate fires.

Large losses frequently occur due to the "happening" of impurities or lack of uniformity in the composition of chemicals and other raw materials, resulting in the batch being thrown out of balance. Such losses as a rule are easily preventable. They can be eliminated by analyses and tests of the batch ingredients. But in spite of this easily enforced precaution, it is not unusual to see factories continue the production of inferior glass for weeks at a time, involving losses of thousand of dollars, before resorting to scientific methods for the solution of their problem.

Tank leaks and breaks have not been universally abolished, but they can be effectually guarded against by the employment of competent engineers, in the first place, to design and build the tanks and afterwards inspect and repair them from time to time. Such insurance against accidents which may tie up a plant for weeks at a time is the cheapest insurance the manufacturer can buy.

Good advice, issued by the Bureau of Mines, against the risks of loss from combustion of stored coal is printed in this number of THE GLASS INDUSTRY.

A striking example of the right way to set about overcoming unfavorable emergency conditions is embodied in the article by C. A. Cole in this issue, describing the means adopted in certain factories to avoid shut-downs due to the impossibility of obtaining dense soda ash during the recent freight congestion. The problems involved in substituting light ash were attacked by scientific methods and solved.

These are merely a few suggestions as to how loss hazards in the producing end of the glass business may be minimized. Concerning such losses, preparedness and prevention are far more effective than attempted cures after the damage has been done. Foresight on the part of the manufacturer, courage to expend money and effort now for future benefits, and expert "head work" applied to the problems to be solved, will bring about the desired result and make the examination of the annual balance sheet a more pleasurable occupation than might otherwise be the case.

Postponement

Publication of the article on THE MANUFACTURE OF MOTHER-OF-PEARL GLASS, announced for this issue, has been postponed until the January number to make room for the paper on THE DEVITRIFICATION OF GLASS presented on page 40. Some of the statements made in the latter article have a bearing on matters discussed in Wilbur F. Brown's paper on THE OCCURRENCE OF CRUST OR SCUM ON CONTINUOUS BOTTLE TANK FURNACES, which makes it desirable that both articles be published in the same number.

Technical Consultation Service

EDITOR'S NOTE: The Glass Industry maintains a department devoted to Technical Consultation Service, to which can be referred not only general questions pertaining to the manufacture of glass, but also personal inquiries covering specific problems constantly arising in factory practice.

Glass men who were consulted, particularly the smaller manufacturers agree that the need for practical technical advice is fast being realized, but in the minds of many men directly responsible for manufacturing processes, there exists no definite idea as to just what so-called scientific work in glass manufacture embraces, or how to go about securing competent advice.

It often happens that what is common-place knowledge to one man is just what another needs to know when new tasks confront him or old methods fail to satisfy. Even the most competent and experienced chemist or engineer, especially when working along new lines, finds an opportunity of consulting others and checking his own results with theirs almost invaluable.

It is hoped that all who so desire will use the Technical Consultation Service whenever they wish. Whether it is to give a method for chemical analysis, or to answer a question about quality of raw materials, or to help solve a vexing melting trouble, we stand ready to serve so far as we can.

Answers to all questions will be made by mail as promptly as possible. The source of all inquiries will be held in strict confidence.

In this second number we are giving one or two actual examples of cases in which technical advice has been of direct benefit to glass manufacturers.

EXAMPLE NO. 1.

A group of successful mercantile men had considerable capital invested in a glass corporation, and for some years they received quite satisfactory dividends therefrom. About two years ago, the glass company started to go behind. In order to conserve their investment, the interested men arranged for a controlling interest in the business, and appointed one of their men to effect a reorganization. He soon found that his German batch-mixer was "double crossing" the company. The mixer was promptly discharged. It was immediately found that he was the only man in the plant, who knew the batch formula. (The glass was a special product, formerly entirely imported from Germany, and was not manufactured elsewhere in this country). A few trials showed convincingly that guessing the batch proportions was hopeless. In desperation an appeal was sent to a reliable glass consultant. By analyses, physical tests, and some trials, he had within ten days duplicated the former product, and the articles turned out met fully all necessary tests.

EXAMPLE NO. 2.

Some large manufacturers were using a well-known high-grade silica sand for the manufacture of amber bottles on automatic machines. Freight rates on the sand made it more than three times as expensive as a nearby sand of less purity. The chemist, familiar with both products, pointed out that for making amber ware the impure sand contained ingredients which made it more desirable than the pure white product. He was at first told that it had been tried before, and did not work. By insistence on his part, and also by having an older and better known consultant emphasize the point, the impure material was finally given a fair trial. It was thoroughly demonstrated that it was more satisfactory both in quality and quantity of ware produced.

It is unnecessary to make comment other than to remark that if the chemist had done nothing else for the manufacturers in question, it would have been a profitable investment for them, if he had been continued on their payroll for two years.

CORRESPONDENCE AND DISCUSSION

While cordially inviting readers' criticisms, and discussions and expressions of opinion on matters affecting the trade, The Glass Industry assumes no responsibility for statements made in communications printed under this head. Names of correspondents will be withheld from publication when so desired.

Westinghouse Plans

To the Editor of THE GLASS INDUSTRY:

The attached newspaper clipping [stating that the old factory of the Rochester Tumbler Company, Rochester, Pa., would be converted to the manufacture of electric light bulbs] is very erroneous, and we are enclosing a copy[1] of the correct item. We thank you for sending this to us for checking before publication.

L. H. ROSENBERG,
Publicity Engineer,
Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

December 2, 1920.

[1]Announcement has been made by the Westinghouse Electric & Manufacturing Company that negotiations are being closed for the purchase of the plant and property of the Independent Lamp & Wire Company, located at Rochester, Pa. Although this plant was formerly used for the manufacture of glass ware, the Westinghouse Company plan to utilize it for the production of micarta materials of all kinds, as well as repair parts for electrical machinery. This plant has a total floor space of upwards of 130,000 square feet.

Glass House Moulds

To the Editor of THE GLASS INDUSTRY:

We wish to take exception to a statement made by the author in the article on page 12 of your November, 1920, issue on "How Glass Factory Mold Castings Are Made," who says:

"At present there are no foundries devoted especially to the production of iron castings for glass house molds."

We have been in business for more than 32 years, and have always, in this time, made a specialty of this line of work, and have been successful in the manufacturing of molds, as the following glass manufacturers will attest: United States Glass Company, Ninth and Bingham street, S. S., Pittsburgh, Pa.; W. S. McKee, 107 Carson street, Pittsburgh, Pa.; Consolidated Lamp & Glass Company, Coraopolis, Pa.; L. E. Smith Glass Company, Mt. Pleasant, Pa., and the Westmoreland Specialty Company, Grapeville, Pa.

We hope you will refer our name to the party or parties who are having trouble in this line of work.

JOHN N. EARLY, *Chairman,*
W. J. EARLY & SONS, LTD.

Pittsburgh, Pa., November 9, 1920.

They Think Well of It Abroad, Too

To the Editor of THE GLASS INDUSTRY:

We have read with much interest the first copy of your magazine, and we should like to have regular copies every month for our young men to study. We therefore ask if you will allow us to become members as a Firm and to pay a further subscription for 11 additional copies, so that we may receive 12 copies of your magazine every month.

If this can be arranged, we shall be glad if you will advise us of the amount due, which we shall then have pleasure in forwarding.

W. L. FOSTER, *Director,*
Chance Brothers & Co., Ltd.,
(Bottle Manufacturers).

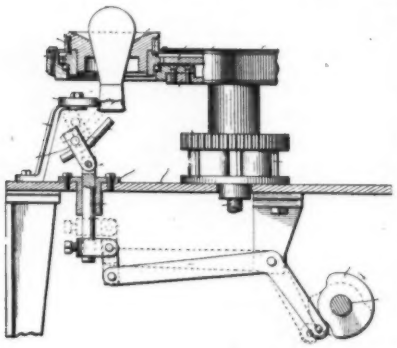
Smethwick, Birmingham, England.
November 25, 1920.

PATENTS

RECENT INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS FOR PRODUCING IT

Machine for Finishing Blown-Glass Articles. U. S. 1,352,396. September 7, 1920. James Bailey, of Corning, New York, assignor to Corning Glass Works of Corning, New York, a corporation of New York.

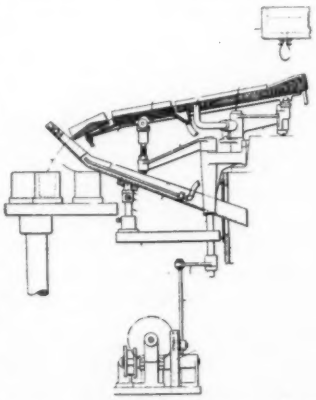
This invention relates to a machine by which a blown glass article having a comparatively thin wall, of which it is desired to remove certain excess portions, is finished. The particular machine shown in the accompanying illustration is one adapted to remove the moil end of an electric lamp bulb after the same has been blown.



The device has for its object to provide a means by which such unnecessary portion may be rapidly and economically removed and the bulb properly prepared for subsequent fabrication. In its most complete form the invention contemplates means for stripping a bulb blown on a blow-iron from such iron, the moil also being removed and left adherent to the neck of the bulb, and for feeding such a bulb with the adherent moil to a turret by which the bulb is carried past proper devices to effect the cutting off of the undesired portions, and to prepare the bulb for fabrication into a lamp. It further contemplates in its most complete form means for removing the bulb from the turret at a desired point.

Glass Working Machine. U. S. 1,353,115. September 14, 1920. Alfred R. Hunter, of Hartford, Conn., assignor to Hartford-Fairmont Company, of Canajoharie, New York, a corporation of New York.

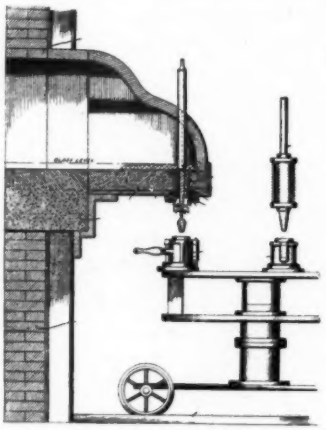
The present invention is an apparatus for intercepting the charges of glass which would otherwise be delivered to a stopped machine or machines, deflecting them from their normal course into a cullet pit or other receptacle, without interfering with the delivery of the charges intended for the companion machine or machines which are not stopped, thus enabling the other machine or machines to be continued in operation.



As shown in the accompanying illustration the invention comprises an apparatus for delivering mold charges of molten glass including a movable delivery trough adapted to deliver the glass from a glass feeding station to a plurality of mold charging stations in succession, of deflecting means adapted to be selectively interposed between said delivery trough and any of said stations, to deflect mold charges from their normal path of delivery to said station while permitting the normal delivery of mold charges to any other station.

Drop Feeding Device for Glass Machines. U. S. 1,353,276. September 21, 1920. Alexander L. Schram, of Hillsboro, Ill., assignor, by Mesne Assignments, to Drey Automatic Glass Machine Company, of St. Louis, Mo., a corporation of Missouri.

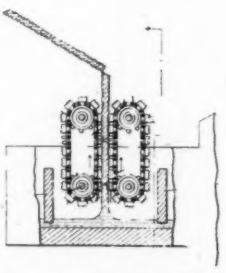
The invention relates to improvements in drop feeding devices for glass machines, wherein partible cup elements and a cutting element conjunctively operate, with a chamber beneath a discharge orifice, to collect and support a batch of glass, flowing from the discharge orifice, in the chamber and free from the sides thereof, release the collected batch and then sever it from the stream flowing from the orifice.



The inventor claims that the object of the improvements is to construct a means for collecting a batch of glass as shown in the accompanying illustration from a stream flowing from the discharge orifice of a furnace and supporting the batch in a heated chamber with its major body portion free from contact with the chamber and a knife for severing the batch from the stream by a clean shear cut whereby to minimize contact with the batch by the gathering means and to obviate irregularities of the batch at its points of cutting or severing from the stream to the end that ware or articles are produced clear and free from checks or markings.

Cutter or Gripper for Use in Drawing Sheet-Glass. U. S. 1,355,449. October 12, 1920. Hudson S. Campbell, of Clarksburg, W. Va.

This invention relates to the manufacture of a cutter and gripper formed of carbon for use in connection with the drawing of sheets of glass.



It has been found that any metallic or refractory substance used for this purpose unless water-cooled will result in the adherence of the glass thereto, and even when water-cooled the chilling effect will penetrate into the sheet of glass beyond the edges and consequently there will not be the hardening or setting of the glass at a uniform degree of temperature throughout its entire area.

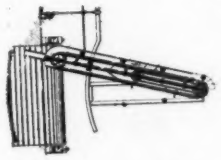
The inventor claims that as the cutting and gripping bars and blocks are made of carbon, no cooling medium is necessary and said bars and blocks will be brought into contact with the sheet of glass while at the same degree of temperature as the glass, and there will be no adherence or sticking of the glass to the carbon and consequently a sheet of glass is obtained which has hardened and set at a uniform degree of temperature throughout its entire area.

Furthermore, the cutter being formed of carbon obviates the adhering of the glass thereto and a clean cut is made while the glass is yet in a plastic condition, so that the cut

can be made just above the molten bath of glass, the point of cutting to be determined by the thickness of the sheet of glass which is being drawn, as sheets of glass of different thicknesses will have to be cut at different distances above the bath of glass from which the sheet is being drawn.

Means for Conveying Ware to Lehrs. U. S. 1,356,167. Oct. 19, 1920. Raymond W. Niver, of Elmira, New York, assignor to the Owens Bottle Machine Company, of Toledo, Ohio, a corporation of Ohio.

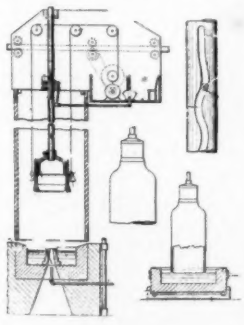
This invention relates to improvements in apparatus for feeding bottles or other ware to a lehr as shown in accompanying illustration. An object of the invention is to provide an apparatus which is practical and reliable in operation for receiving the bottles or other articles supplied from the forming machine, conveying them to the lehr and evenly distributing them in spaced relation on the lehr conveyor.



In its preferred form the invention comprises an endless carrier mounted on a swinging horizontal table for conveying the bottles to the lehr. The forward end of the table is arranged to swing transversely across the front end of the lehr, means being provided for moving the table step by step so that the bottles discharged from the conveyor are arranged in a row extending across the lehr. A suitable device for transferring the bottles from the conveyor table to the lehr comprises a gripper to engage the bottle at the forward end of the conveyer table and means to actuate said gripper to carry the bottle into the lehr. A sliding door extending across the front end of the lehr is connected with the conveyer table and moved across the lehr step by step with said table. Said door serves to close the end of the lehr, except at the small opening therein, through which the bottles enter the lehr. Suitable mechanism is provided for operating the several parts in timed relation to each other and to the delivery of the ware thereto.

Manufacture of Window-Glass. U. S. 1,356,739. Oct. 26, 1920. Clyde S. Robb, of Charleroi, Pennsylvania, assignor of one-half to Charles J. Kunzler, of Pittsburgh, Pennsylvania.

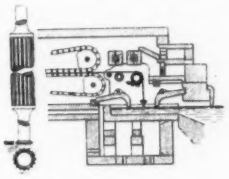
This invention has in view to impart to the drawing mechanism, in the operation of making machine drawn glass cylinders, a rotative action back and forth coincident with the longitudinal draw or formation of the cylinder, whereby a similar effect to that found in hand-wrought glass is obtained. Ordinarily, the bait in such operation is first lowered upon and slightly below the surface of the molten glass by a vertically operable suspending rod, and after the neck is formed, the bait is then slowly drawn upwardly, air being supplied in graduated amounts whereby to expand the cylinder to the desired diameter and to maintain it thereat uniformly during the drawing operation.



As will be noted from the accompanying illustration the invention provides means for imparting the rotative action to the bait above noted so that, as the cylinder is formed by the upward drawing movement of the bait, the wall in formation is continuously subjected to a slight twisting action, first in one direction, then in another, so that the resulting cylinder is toughened and greatly improved in the manner noted.

Method and Apparatus for Making Sheet-Glass. U. S. 1,358,390. Nov. 9, 1920. Thomas S. Owens, of Toledo, Ohio, assignor to the Libbey-Owens Sheet Glass Company, of Toledo, Ohio, a corporation of Ohio.

When a sheet of glass is drawn from the molten mass, the surface is cooled by the air so that a glaze is formed which is as perfect as any that could be produced by polishing or other artificial means. The sheet of glass, however, is soft and plastic until it has been drawn a considerable distance from the source of supply. It thus becomes necessary to provide a support over which the glass is drawn and which must be positioned to engage the glass where it is still soft and susceptible to any impression. It has been found in practice that the surface of the glass is always marred by such support. Ordinarily this support consists of a metal bending roll which serves to support the glass and change its direction from vertical to horizontal. Such roll must be run at the surface speed of the glass and the latter takes the impress of every unevenness or irregularity in the surface of the roll, thus lowering the quality of the glass.

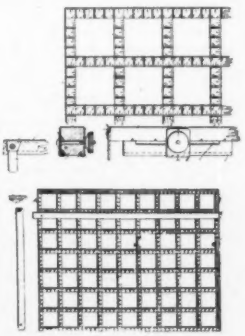


The object of this invention, shown in accompanying illustration, is to provide means for bending or deflecting the glass from a vertical to a horizontal direction without marking or marring the surface of the glass. To this end, in place of the usual metal bending roll, a bending device consisting of a material which may have a sliding movement relative to the surface of the glass without marring or impairing such surface is provided. For this purpose the bending device may consist of wood, or an equivalent (such as the paste materials commonly used in paste molds), which permits a slipping or relative movement of the surface of the glass over the bending device. The bending device may consist of a roll driven at a higher surface speed than the glass. The roll may be either rotated or reciprocated lengthwise, or may have a combined rotation and reciprocation. To prevent the bending roll from being destroyed by the heat of the glass, the invention provides means for keeping the surface of the roll wet or damp.

Glass-Cutting Frame. U. S. 1,357,474. Nov. 2, 1920. Frank C. Remsberg, of Santa Ana, California.

It is common practice among glaziers to use a table covered with a fabric, and having scales on the left hand and lower edges, for the support of glass panes, when cutting the latter.

This invention relates to a frame serving as a table for like purposes, as shown in the accompanying illustration.

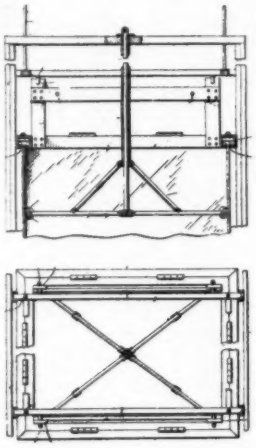


The object of this invention is to provide an open spaced frame, which will serve as a means for setting and aligning the straight edge for guiding the glass cutter and the glass panes to be cut, also to provide a frame of the character described with adjustable stops of a novel character adapted for abutment by the pane or straight edge.

In addition to the broader features of this invention, there are certain details of construction, whereby a simple, convenient frame, light in weight is obtained, and whereby a structure having a certain amount of resiliency and flexibility so as to conform to the surface of a glass pane, may be secured.

Glass-Drawing Machine. U. S. 1,354,391. September 28, 1920. Felix L. Goffaux, of Arnold, Pennsylvania.

This invention relates to improvements in glass drawing machines and the principal object of the invention is to provide means for drawing several sheets of glass at one time, also to provide means for drawing a rectangular tube of glass and to provide roller means for engaging the inner corners of said tube with means for inserting or withdrawing the roller means through the bait.

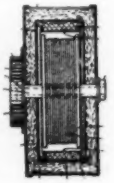


Another object of the invention is to so construct the bait that enough of the melted glass will be held thereby so as to prevent too rapid cooling off of said bait.

The machine as will be seen from the accompanying illustration and as claimed by the inventor, comprises a shaft, an elevator therein, a rectangular bait carried by said elevator, a tubular member adjustably connected with the shaft and extending through said elevator and bait, a rod passing through said tubular member and vertically movable therein, arms pivotally connected to the lower end of said rod, links connecting said arms to the lower end of the tubular member and rollers carried by the outer ends of said arms.

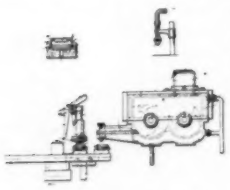
Device for Severing Glass. U. S. 1,359,172. Nov. 16, 1920. Harry F. Hitner, Wilkinsburg, Pa., assignor to Pittsburgh Plate Glass Company, a corporation of Pennsylvania.

This invention for severing glass consists of a glass cracking off device, a heating chamber, a reel in the chamber, a flexible cracking off member wound on the reel and adapted to be withdrawn from the chamber, and also means for heating the chamber as shown in the accompanying illustration.



Method for Preparing Lenses and the Like for Grinding and Polishing. U. S. 1,358,676. Nov. 9, 1920. William Taylor and Francis William Preston, of Leicester, England.

This invention relates to improved methods for mounting lenses and the like in preparation for grinding and polishing operations, and is particularly directed to methods of conditioning the binder by means of which the lenses are mounted.

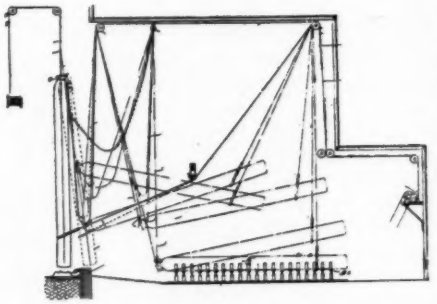


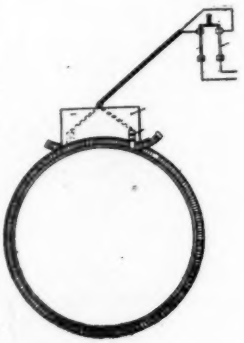
The cementitious or binding material employed may be a compound capable of being softened by heat, and in such case usually comprises a bituminous substance and a stiffening agent. Of these, the bituminous substance may be coal-tar pitch, wood-pitch, natural bitumen of suitable quality, or any similar substance or mixture, while the stiffening agent, which is incorporated with the pitch, may consist of finely-divided mineral matter such as wood-ash, yellow-ochre, or other substance which, in addition to stiffening the mixture, is adapted to reduce the thermal expansion of the mass and capable (if of suitable character for such purpose) of increasing its thermal conductivity. A composition which has been found satisactory in practice comprises the following proportions by weight:—

Coal-tar pitch.....2 parts.
Wood-ash.....1 part.

Takedown for Machine-Drawn Cylinders. U. S. 1,359,236. Nov. 16, 1920. Henry J. Douchamp, Smethport, Pa., assignor to Smethport Glass Company, Smethport, Pa., a corporation of Pennsylvania.

In this take-down device, the combination includes means for lowering the bait end of a cylinder; two cables, one supported at a point adjacent the lowering means, and the other supported at a point distant from the lowering means, the first-mentioned cable having means for attachment to the bait end of the cylinder, and the other having means for attachment to the hole end of the cylinder, a third cable supported at a point between the points of support of the first two mentioned cables and adapted to be attached to the bait end of the cylinder. The first two mentioned cables may also be varied in length during the take-down operation.



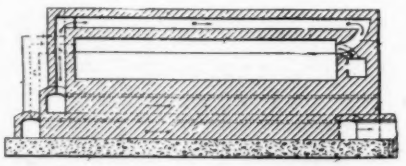


Glass-Cutter. U. S. 1,359,751. Nov. 23, 1920. John R. Scohy, Okmulgee, Okla.

This glass-cutter consists of a plurality of disks, a means for drawing the disks together and causing the disks to make closer contact on one side than on the other side, and for connecting the disks with a source of current supply.

Furnace for Melting Glass and Other Purposes. U. S. 1,359,756. Nov. 23, 1920. John Schofield Shaw, Pool, near Leeds, England.

This invention relates to a furnace for melting glass and other materials in which a regenerator for heating the air is dispensed with. A bath for receiving the material to be melted is arranged in the interior of the furnace and with a combustion chamber above it. Two sets of longitudinal flues are arranged on different levels below the bath and one air flue longitudinally arranged above the bath, one of the lower sets of flues being employed for the admission and heating of the cold air by the radiation of the heat from the bottom of the bath during its passage from the outside of the furnace to the combustion chamber. The other set of flues being employed for conveying the waste gases and products of combustion from the rear end of the combustion chamber, the incoming air and the waste gases being arranged to travel in opposite directions. There are two sets of vertical flues at the rear of the furnace for respectively connecting the lower air inlet flues with the upper longitudinal flue, and with the rear of the furnace, a number of passages for connecting the upper longitudinal flue to the combustion chamber, and a gas chamber connected by a number of passages to the combustion chamber for conveying the gas to the chamber for combustion purposes.



Glass Factory Equipment and Supplies

THE GLASS INDUSTRY will be glad to publish in this department descriptions of new and useful devices, machinery and supplies of interest to the glass manufacturing trade.

The New Hess Preheating Burner

NOW BEING TRIED OUT AT THE PLANT OF THE CLARKSBURG GLASS COMPANY.

A new patented preheating gas burner of novel design, the invention of John G. Hess, Sr., has been constructed at the works of the Clarksburg Glass Company, Clarksburg, W. Va., where a practical test of its efficiency is now under way. According to a report received from John G. Hess, Jr., son of the inventor, the producers were started at 10 A. M., November 25, and at about 4 P. M., the same day, six hours after the producers went into action, the gas was turned into the tanks, and at the time of Mr. Hess' report, November 27, the device was said to be doing "phenomenal work."

The object of the invention is to provide an improved burner for continuous heating furnaces, by means of which a thorough intermingling of the gas and heated air before entrance into the combustion chamber is accomplished and which may be used for either natural or artificial gas in furnaces having only a single set of checkers without the necessity of rebuilding the furnace.

In the burners heretofore in use, the inventor states, the gas is conducted through one flue and the air through another, usually

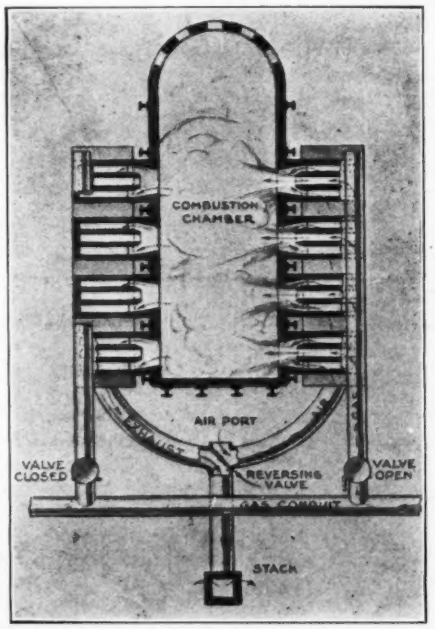


FIG. 1. DIAGRAMMATIC PLAN OF A FURNACE EQUIPPED WITH THE NEW PREHEATING BURNER; IN THE POSITION OF THE REVERSING VALVE INDICATED, THE GAS AND AIR ARE ENTERING AT THE RIGHT AND EXHAUSTING AT THE LEFT.

on top of the gas flue; consequently the gas comes in contact with the air on one side only, which results in a waste of fuel. Moreover, when it is desired to force the furnace to create a higher degree of heat it frequently happens that the gas will smoke because of insufficint mixing with hot air. Furthermore, many furnaces intended for the use of natural gas have been built with only one set of checkers, since natural gas is led into the furnace directly from the side without preheating, while artificial or producer gas requires preheating, and for this reason should it become necessary to resort to the use of artificial gas, as is frequently the case, this can only be done by building an additional set of checkers, and as in many furnaces there is not sufficient room for this additional set of checkers it is necessary to go to the enormous expense of tearing out the entire furnace and rebuilding the same.

In the present invention, owing to the construction, as shown in the accompanying illustrations, should it become necessary to change from the use of natural gas to artificial or producer gas the necessity for building an additional set of checkers is avoided, since, owing to the relative locations of the gas and air flues, the gas is preheated by the air which has been heated in the checker chamber to a very much higher degree than in furnaces as ordinarily constructed.

Fig. 1 is a sectional plan view of the combustion chamber of a continuous heating furnace embodying the improved burner: Fig. 2 is a vertical section on an enlarged scale, showing the arrangement of gas and air ducts and Fig. 3 is a horizontal section through the burner as adapted for the use of natural gas.

In the latter case, the gas is delivered through small pipes, entering directly from the sides of the burner. It will thus be seen that in changing from the use of natural gas to artificial gas

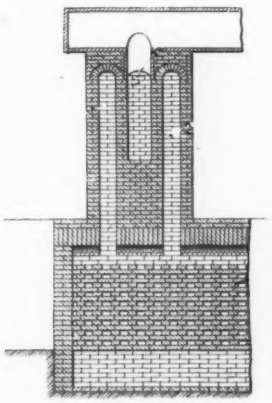


FIG. 2

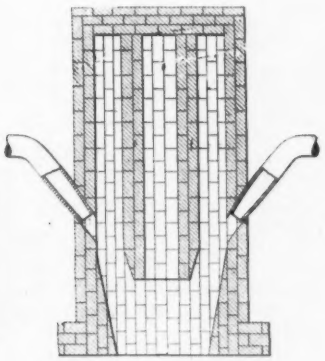


FIG. 3

the only change necessary in the furnace is to place the gas supply pipe above the burner so that the gas is delivered into the duct to be heated by reason of the contiguity of said duct to the hot air ducts on either side.

Though provision has been made for the heating of the gas before mingling with the air, there is no checker chamber through which the gas must pass in order to be so heated. In furnaces as heretofore constructed, in which the gas was heated by passing the same through a checker chamber, every time the circulation was reversed, more or less gas was left in the checker chamber to be carried off up the stack, and as such reversing ordinarily takes place at least three times an hour the loss from this reversal was considerable; but, by building the gas ducts as illustrated, a pocket is formed wherein is retained any gas that may be in such ducts or pockets when the reversal takes place.

The inventor claims that success of his simple and economical device will mean the end of complicated, cumbersome and costly double checkers for producer gas.

The Polish Glass Industry

Reported for THE GLASS INDUSTRY by F. A. EWELL[1]

The Polish glass industry is greatly hampered at present by the transportation difficulties, which render its obtaining of coal and raw materials very hazardous, but in spite of that fact I am reliably informed that thirty carloads of commercial glass were shipped to England within the last month.

Practically all the glass being manufactured now in Poland is commercial glass of a rather rough quality, and there is at this time no manufacture of glass for chemical, medical or geological uses. It is expected that within six to ten months such manufactures will be resumed on a rather large scale, at least sufficient for domestic needs. Most of the importations of glass into Poland are made from Germany, where more favorable prices can be offered than in America. There is some talk of importing glass tubing, and the re-export of the finer finished products to America. I am assured that exportation of commercial glass could take place on a fairly large scale, if there were transportation within Poland sufficient to supply the needs of the glass factories for coal and raw materials.

In Prussian Poland the glass manufactories are not numerous and are of very small importance. In Galicia and Silesia of Teschen in 1910 there were 12 manufactories, employing 668 workmen. The value of the production was 2,625,000 francs. In the table of export of mining and industrial products of Galicia, the value of the glass export is given as 1,050,000 francs. In Congress Poland in 1910 the glass works and dependent industries gave occupation to 5,820 workmen, and the value of the production was 19,570,250 francs. A table of industrial production from 1910 to 1912 gives the following figures for glass articles:

1910	1911	1912
40,100 tons	34,000 tons	34,900 tons

Value of average annual production: 14,200,000 francs.

Lithuania and White Ruthenia are poor in minerals. The sandy soil of the Province of Mohylev furnishes a quartzy sand for glass manufacture. A table of foreign trade gives the following figures:

PROVINCE OF VILNO

Glass imported, 8,000 quintals. Value, 260,000 francs.
Glass articles and utensils exported, 35,000 quintals. Value, 290,000 francs.

PROVINCE OF GRODNO

Glass imported, 8,000 quintals. Value, 254,000 francs.
Glass articles and utensils exported, 12,000 quintals. Value, 774,000 francs.

PROVINCE OF KOVNO

Glass imported, 5,000 quintals. Value, 175,000 francs.
Glass articles and utensils exported, 4,000 quintals. Value, 254,000 francs.

LITHUANIA

Glass imported, 21,000 quintals. Value, 689,000 francs.
Glass articles and utensils exported, 43,000 quintals. Value, 809,000 francs.

The above figures are calculated from railroad statistics for the years 1909, 1910 and 1911.

At the present time, the largest factory engaged in the manufacture of all kinds of glass-ware is Czechy, Pilawa, Z. Harszawska; and the most important dealers are T. Osicki, Wierzbowa 1, Warsaw; and Cmielow, Warszalkowska 13, Warsaw.

We are informed that the following firms are interested in the importation of china and glass products: W. Gasior & Skaw, Warsaw, and R. Ciescielski, 11 Warecka, Warsaw.

NOVEMBER 15, 1920.

[1] Assistant Secretary, American Polish Chamber of Commerce.

British Glass News

LONDON, England, November 17, 1920.—There is no slackening in the demand for all types of glassware, and although increased supplies of fuel of the quality required are now becoming available, together with some easement of the labor situation, owing to the increased adoption of automatic machinery, output is still inadequate to meet requirements. But there is a gratifying improvement each month, and the time should not be far distant when expansion in overseas trade will be a welcome outlet for increased production.

The production of glass bulbs used in the manufacture of electric lamps is rapidly increasing. The Osram-Robertson Electric Lamp Works, who have their own glass factory, have greatly increased their factory equipment for making electric lamps, and have found it necessary largely to increase the production of glass bulbs at their Leamington glassworks. Two Westlake automatic bulb-making machines and furnaces have been installed, at a cost of over $100,000. When running full capacity these machines should produce probably 300,000 bulbs per week, and as, with the exception of mechanics, unskilled labor only is required, the adoption of these machines should have a beneficial effect in liberating skilled glassworkers for the production of other type of glassware urgently needed, and to which it is not possible at present to apply machine methods.

The first large tank furnace at the new Canning Town (London) Works, erected by British Glass Industries, Ltd., has been successfully brought into operation, and it is understood glass containers of high quality are being produced from it. The remaining eight furnaces comprising the new works are well on the way to completion and further units will be brought into operation at an early date.

Rapid progress is being made in the construction of new works for the Rockware Glass Company, and it is anticipated that it will be possible to commence production very soon. These works will for the present be confined to the output of "white glass" milk bottles, for which there is a very large and increasing demand.—H. L.

MANCHESTER, England, November 20, 1920.—It is rather difficult to give a review of the British glass industry just now as labor conditions are very unsettled, and as there are so many new plants being established and old ones being extended, it is impossible to get a correct idea of just what is going on. The industry, here, however, seems to be taking on new life and, while there are some old and out of date plants, many of the manufacturers are trying hard to bring their factories up to date. It is hardly probable, however, that they will ever be able to make glass as cheap as it is in the United States, the supply of sand not being good and the only available coal is not a very good gas making grade. Coal is the only fuel obtainable here.

One of the reasons for the backwardness of the British glass industry in the past is, no doubt, the fact that manufacturers allow practically no one, especially strangers, to go through their plants. Consequently they do not find out how to do things in new and better ways. I note that a delegation of British glass makers recently visited the glass districts of the United States and I am sure that they would secure more information over there on a trip of this kind than they could get from one another here in years.

With the enormous freight rates now maintaining both for rail and ocean transportation, there is no doubt of the advisability of developing the industry in Great Britain. There is an enormous market to supply and while there is still room for American goods to come in here, the opportunities in this line will gradually decrease as up-to-date machinery and methods are installed in British factories.

All in all, there is a very bright future for the British glass manufacturers, the only cloud that at present envelops them rising from the labor situation. D. A. R.

TRADE NEWS

The American Dressler Tunnel Kilns, Inc., has moved its executive, engineering and thermal offices to 1740 East 12th Street, Cleveland, O.

On November 30, a fire, which started in the silvering department of the Thatcher-Kerwin Glass Company, St. Louis, Mo., damaged the plant to an estimated extent of $25,000.

The Tuna Glass Company is installing producers at its plant in East Clarksburg, W. Va., and expects to resume operations about January 1. It will employ about 140 men. The plant has been closed since the latter part of September.

The Capstan Glass Company, manufacturers of packers' glassware, Connellsville, Pa., has taken over several buildings near its plant which will be used for factory and storage purposes. The buildings occupy about 30,000 square feet.

The Winslow Glass Company, Columbus, O., which manufactures milk bottles exclusively, has just completed the installation of a fuel oil system of heating to supplement natural gas. This company recently was cut out of natural gas, hence the oil system was put into operation.

The two factories, Nos. 3 and 4, of the Whitall Tatum Company, at South Millsville, N. J., are being razed and as soon as the work is completed construction on a new tank will be started. The company is dismantling its plant at Stroudsburg, Pa., and all available material will be used in building the new tank.

The Accurate Thermometer Company, Chicago, Ill., manufacturers of all kinds of thermometers, hydrometers, and chemical glassware, etc., has been purchased by the Scranton Glass Instrument Company, 322 North Washington avenue, Scranton, Pa. The stock and machinery of the Chicago company is being moved to Scranton.

In connection with press reports stating that the Monongah Glass Company, manufacturers of pressed and blown tumblers and stemware, Fairmont, W. Va., contemplate extensive additions to their plant, officers of the company inform THE GLASS INDUSTRY that the only work in progress at its plant at the present time is the enlargement of the mold shop.

Press reports, not yet confirmed, from the home town of the Corning Glass Company, Corning, N. Y., state that because of the establishment of new plants at Wellsboro, Pa., and Kingsport, Tenn., the company has reorganized. The report states that its outstanding stock amounting to $1,000,000 will be withdrawn and 200,000 shares of stock of no par value issued.

J. Goebel & Co., 67 Cortlandt street, New York, sole importers of Grossalmerode glass house clay, have announced that they are working to secure price reductions and also that they expect, within the next six months, to be able to take care of all their customers' requirements. Orders have been coming in recently, they state, on such a large scale as to tax their delivery facilities.

The Eastern Potash Corporation of New York is constructing a plant to produce potash from the green sands found in large quantities in New Jersey. These sands contain 7 or 8 per cent of potash. The new works will have a capacity of a thousand tons of potassium oxide annually. After extracting the potash from the sand, the residue will be utilized in the manufacture of silica-lime brick.

The plant of the Standard Glass Company, Marion, Ind., was entirely destroyed by fire on October 30, the estimated damage being between $75,000 to $100,000. The company states that as near as they have been able to determine the flames were started from burning soot, caused from blowing out on Saturday evening after work. They expect to erect a new building of steel and corrugated asbestos construction and the plant will probably be in operation within the next two months.

About three hundred men were thrown out of employment at Pleasantville, Ohio, a small town east of Columbus, by the burning of the plant of the Pleasantville Window Glass Company, on November 27. The flames started in the furnace at 7 P. M. and spread rapidly. Since Pleasantville has no fire department the fire could not be controlled until the arrival of the fire department from Lancaster, Ohio, a dozen miles away, and the entire plant with the exception of the office and warehouse was destroyed. The loss is estimated at $100,000.

The stock room and contents, which consisted of 6,000 gross of bottles, packed for shipment, at the plant of the Old Dominion Glass Company, Alexandria, Va., were destroyed by fire on November 4. Officials of the company report that the loss was about $25,000. The fire did not affect the operation of the plant, but it was closed on November 20 because of inability to obtain coal and as a result 250 men were thrown out of employment. Lorenzo Welford, president, reports that the plant may not reopen until spring, but this will probably be definitely determined at a directors' meeting to be held in the near future.

Walter Cox, president of Pennsylvania Wire Glass Company, Philadelphia, Pa., announces that due to the need of additional manufacturing facilities, especially for their corrugated wire glass, which has had a large sale, the company has decided to build a plant at Lewiston, Pa., where they have purchased 30 acres of ground. The plans call for 10 buildings; the main one will be 170 feet wide by 600 feet long. The nine other buildings will include a hay storage and packing house, producer building, boiler-house, batch-mixing building, chemical laboratory, physical laboratory and experimental machinery building. Actual construction will probably not begin until next Spring.

J. William Gayner, vice-president, Gayner Glass Works, Bridgeton, N. J., reports that his company has made large additions to their plant to take care of the growing demand for glass battery jars. They are installing the most modern automatic machinery to make this line of ware. Mr. Gayner states that during the last 25 years through which they have been serving the electric trade, the shapes and styles for glass battery jars have changed very materially, and the Gayner Glass Works has developed with them, its engineering force aiding from time to time with new designs for the storage battery trade. The company now makes battery jars weighing from 3 ounces up to 25 pounds.

The Libbey-Owens Sheet Glass Company, Hamilton, Canada, reports that at a recent meeting held in Toronto, Canada, the following officers were appointed: President, Ralph King, vice-president, and managing director John W. Hobbs, both of Toronto, and directors, William Ford, Cincinnati, O.; J. T. Richardson, Toronto, and S. B. Henshaw, Charleston, W. Va. According to press reports, work has been started on the factory at Hamilton, Canada. The main building will be 558 ft. by 150 ft., the front part of which will be four stories high, while the remainder will be two stories. Another building will be 341 ft. by 77 ft. The plans also include a power plant and producer gas plant and six concrete storage tanks, which will each be 25 ft. 6 in. in diameter and 42 ft. in height. When completed the buildings will cover about ten acres of land.

Many plants in West Virginia were forced to close as a result of the shortage of gas brought about by the first severe cold weather of the season and a blizzard which swept over greater Clarksburg on November 17. Over 1,000 men employed at industrial plants in the local district were idle. Many of the plants forced to close down were glass factories and they included the Norwood Glass Company, the Clarksburg Glass Company, the Liberty Glass Company, and the Thatcher Glass Company.

Because the Ohio Fuel Supply Company has refused to permit the use of natural gas for glass making, four glass companies in Lancaster, O., and vicinity were compelled to close down. The companies affected were the Lancaster Glass Company, the Hocking Glass Company, the Columbus Window Glass Company, the Pleasantville Window Glass Company at Pleasantville, about 12 miles from Lancaster. In all approximately 1,600 people were thrown out of employment by the shut-down. The Lancaster Glass Company reports that they were only idle twenty-four hours as a result of the gas shortage, and at the end of that period resumed operation, as did the Hocking Glass Company. The Columbus Glass Company has shut down indefinitely.

The Buckeye Window Glass Company, of Columbus, O., which has a large plant on Bonham avenue, has been closed down since November 26, 1919, as a result of an order of the Public Utilities Commission of Ohio refusing to supply natural gas. This concern had been using natural gas since starting, and the entire plant was built with that idea in view. Work was started more than a year ago to erect an artificial gas plant, with all the equipment, to produce gas from coal. This plant is now nearing completion, and will be ready for operation soon. Another difficulty, however, arises in the coal supply. The plant cannot be started until a good coal supply is on hand, and that is a difficult matter now. The present plans are to open the plant sometime prior to February 1 of next year. In making the change it was necessary to remodel the flattening ovens as well as melting tanks. Charles D. Bartram is president and general manager of the concern.

Announcement has been made of the merger of a number of window glass plants, the consolidation to be known as the Interstate Window Glass Company, largely as a result of patent litigation against independent window glass companies won by the American Window Glass Company. It is reported that the principal offices of the company will be maintained in Pittsburgh, with branches in various cities. The plants interested in the merger will be taken over by the new company on January 3, 1921, and include the Consolidated Window Glass Machine Company, Bradford, Pa., with plants at Hazelhurst and Mt. Jewett, Pa.; the Empire Glass Company, Shinglehouse, Pa.; the Pennsylvania Window Glass Company and the Kane Glass Company, of Kane, Pa.; the Smethport Glass Company, Smethport, Pa.; the Crescent Glass Company, Weston, W. Va.; the Tuna Glass Company, Clarksburg, W. Va.; the Camp Glass Company, Huntington, W. Va.; the West Fork Glass Company, Clarksburg, W. Va.; the Columbus Glass Company, Lancaster, O., and the Okmulgee Window Glass Company, Okmulgee, Okla.

The officers of the new company include, as president, H. J. Walter; vice-presidents, T. W. Camp, Smethport, Pa., and W. S. Calderwood, Kane, Pa.; secretary and treasurer, F. D. Gallup, Smethport; and the following directors: H. J. Walter, T. W. Camp, George W. Mitchell, Smethport; T. E. Kobelgard, Weston, Pa.; Henry McSweeney, Atlantic City, N. J.; Charles Wandless, Lancaster, Ohio; Charles L. Suhr, Oil City, Pa.; W. S. Calderwood, A. H. Gaffney and R. A. Hill, both of Kane, Pa., and L. S. Shelton, Okmulgee, Okla.

It is also expected that several other plants will join the merger within a short time. Reports that the La Flore Glass Company, Poteau, Okla., and Baker Brothers plant at Okmulgee, Okla., were included in the consolidation were unofficially denied.

Illinois Glass Carton and Label Plant

The Illinois Glass Company have practically completed their new carton and label plant at Chicago, Ill. This new factory is thoroughly modern in every respect—with sawtooth roof, steel sash, sprinklered, positive pump driven heating system, "Kreolite" wood block floors, and its location at the corner of Wrightwood and Crawford Avenues, Chicago, is one of the finest in the country as regards labor supply and accessibility.

The mechanical equipment will consist of the most improved types of one and two color printing presses and a battery of cutting and creasing presses, paper cutting, die cutting, and punching machines and automatic gluing machinery of the most modern character.

A great deal of thought has been devoted to the question of handling the stock or board. In order to secure low labor cost and reduce wastage in this connection all standard mechanical stock handling devices that proved adaptable to the particular needs of the company's trade have been installed and a number of special devices of their own design have been utilized.

An important feature of the layout is the scheme of continuous "straight-line" travel of the flow of production. The product in the course of its conversion from the raw material into the finished product practically completes a square, with no reverse travel at any point.

The additional facilities provided by the new plant will still further improve the Illinois Glass Company's already excellent carton and label production service.

Trade Literature

The Manufacturers Equipment Company of Dayton, Ohio, has issued a 20-page pamphlet describing and illustrating the Underwood producer gas system and the Meco gas producers and other equipment manufactured by them for glass manufacturing and other industries. Considerable information of a general nature, relating to the manufacture of producer gas and its application to various industries is given. Copies of the pamphlet will be mailed to interested persons upon request.

Financial

Papers have been filed with the Secretary of State increasing the authorized capital of the Hocking Window Glass Company, Lancaster, O., from $30,000 to $1,200,000.

The regular quarterly dividend of 3 per cent. on the common stock and 1¾ per cent. on the preferred stock of the American Window Glass Machine Company, payable January 1, 1921, to holders of record of December 10, 1920, has been declared.

According to a notice filed recently with the Secretary of State of Delaware, the Simplex Engineering Company, Washington, Pa., contracting and consulting engineers for muffle lehrs, producer plants, power plants and other glasshouse equipment, has increased its capital from $100,000 to $350,000. E. C. Frazier, formerly chief engineer for the Hazel-Atlas Glass Company, is head of the Simplex Company.

In addition to the regular quarterly dividend of $2 a share, the directors of the Pittsburgh Plate Glass Company recently declared a stock dividend of 20 per cent on each share of the common stock, both dividends being payable December 31 on stock of record on December 15. Formal approval of the merger of the Pittsburgh Plate Glass Company, the Columbia Chemical Company and the Patton-Pitcairn Company was recently made by the Pennsylvania authorities, and as a result of the consolidation the capitalization of the Pittsburgh Plate Glass Company is now placed at $37,500,000.

Associations and Societies

American Ceramic Society Annual Meeting

The 1921 Annual meeting of the American Ceramic Society will be held on February 21 to 24, 1921, at Columbus, Ohio, where the Hotel Deshler has been engaged as headquarters. The management of this new and commodious hotel has promised to reserve the ball-room and four other rooms on the same floor, so that the general meetings of the Society and the divisional meetings will be taken care of adequately.

Details of the entertainment are in the hands of the local committee, of which Professor A. S. Watts is chairman, and it is expected that the usual Section Q, or smoker, will take place on Monday night, with the banquet on Tuesday. Those who recall these delightful events at the Philadelphia meeting will not fail to be present this year.

The trips to be taken on the last day of the meeting will be replete with interest, as Columbus is situated at the very heart of the clay working industry.

The literary program, if it may be judged by past experience, will be filled with papers of a high degree of excellence. The arrangement of the program is in charge of the chairman of the Committee on Papers, R. H. Minton, General Ceramics Company, Metuchen, N. J., and contributors should communicate with him.

Glass Container Association and National Bottle Manufacturers' Asociation

Features of the meetings of the Glass Container Association at Chicago, Ill., scheduled for December 8, include an address by Judge I. G. Jennings on "Our Publicity Progress", luncheon at Terrace Gardens for guests of the Association, demonstrations under the direction of Dr. A. W. Bitting at the laboratories of the Glass Container Association at 3344 Michigan avenue, and an informal dinner at the Hotel La Salle and theatre party in the evening for members and guests of the National Bottle Manufacturers Association and the Glass Container Association.

The program of the National Bottle Manufacturers' Association meetings, at the Hotel La Salle, December 9, includes a presentation of a series of graphic charts showing comparison of new business booked, period by period, this fall, as compared with last; presentation of comparative data on operating rates, indicating, among other things, recent increases in operating rates due to advances in many items of expense; wage settlement report of the executive committee.

Industrial Cost Association

A. A. Alles, Jr., secretary and treasurer of the Industrial Cost Association, is calling the attention of the glass trade to the importance in all business institutions of knowing the cost of production. In spite of the fact that practically all manufacturers have cost systems in operation very few know their actual costs. To remedy this situation a group interested in cost problems got together last June in Chicago, Ill., and organized the Industrial Cost Association. Representatives of a large number of prominent industrial concerns have affiliated themselves with this organization and local sections have been organized, including one at Pittsburgh. L. Springer Cunningham, representing the National Association of Window Glass Manufacturers, is a member of the Pittsburgh Organization Committee. M. F. Simmons, of the General Electric Company of Schenectady, N. Y., is president of the Industrial Cost Association; C. H. Smith, of the Westinghouse Air Brake Company, Wilmerding, Pa.; first vice-president; Roland H. Zinn, of the Tanners' Council, New York, second vice-president; and A. A. Alles, Jr., secretary and treasurer. The association's headquarters are in the People's Bank Building, Pittsburgh, Pa., where further particulars may be obtained by those interested in solving production cost problems.

Employment in New York Factories

According to the New York State Industrial Commission a 7 per cent increase took place in the number of workers employed in the glass industry in New York State during the month of October. This increase, which was in contrast to a decrease of from 10 to 44 per cent in a majority of other industries, was attributed to the usual expansion in activity following the dull summer months in the glass plants.

Society of Glass Technology

Advices from Professor W. E. S. Turner, head of the Department of Glass Technology, Sheffield University, England, and secretary of the Society of Glass Technology, state that a reunion of the members of the party of glass manufacturers and chemists who recently made a tour of the glass factories of the United States as guests of the American Ceramic Society, is being arranged. Proessor Turner states that our recent visitors look back on their tour with most pleasant recollections and with kindest remembrances for all of the friends they made in America.

American Society of Mechanical Engineers

During the forty-first annual meeting of the American Society of Mechanical Engineers to be held December 7 to 10, 1920, in the Engineering Societies Building at 29 West 39th street, New York, a meeting in honor of the late Dr. John A. Brashear, famous optical glass manufacturer and past-president of the A. S. M. E., will be held on Wednesday evening, December 8. An oration on his life and work will be delivered by Dr. Henry S. Pritchett, president of the Carnegie Foundation for the Advancement of Teaching.

Charles Albert Tatum

Charles Albert Tatum, president of the Whitall Tatum Company, glass manufacturers, of New York and Philadelphia, died on November 13, at his residence, in Middletown, N. J., after a brief illness. Mr. Tatum was born in Philadelphia, Pa., on January 17, 1849. He entered the firm of Whitall Tatum & Co. on July 1, 1875, and was elected president of the company when it was incorporated, in 1901.

Mr. Tatum was a member of the New York Athletic Club, Metropolitan Club, New York Botanical Gardens, Metropolitan Museum of Art, Indian Harbor Yacht Club and Greenwich Country Club. He was at one time president of the J. Hood Wright Hospital, now known as the Knickerbocker Hospital. Mr. Tatum is survived by a son, Frederick Cooper Tatum.

Nicholas Dannenhoffer

Nicholas Dannenhoffer, a retired glass manufacturer, died on November 11 at his home in Brooklyn, N. Y. Mr. Dannenhoffer was eighty-one years of age and was born in Alsace-Lorraine, coming to this country sixty years ago at which time he established the Williamsburgh Flint Glass Works at Williamsburgh, N. Y., which he owned and conducted until ten years ago, when he retired. Mr. Dannenhoffer is survived by two sons and four daughters.

Personal

At a recent meeting of the board of directors of the Federal Glass Company, Columbus, O., Irving E. Adams was appointed Superintendent. Mr. Adams has been acting superintendent of the plant for some time past.

A. B. Paxton, of the Hazel-Atlas Glass Company, Wheeling, W. Va., and his son, Alexander N., sailed from New York on the *Carmania* on November 20. Mr. Paxton expects to spend several months abroad looking after business for the company and will visit England, France and Spain.

MONTHLY SUMMARY OF FOREIGN COMMERCE OF THE UNITED STATES.

Corrected to October 28, 1920.

IMPORTS OF GLASS AND GLASSWARE.

Articles	September 1919 Quantity	September 1919 Value	September 1920 Quantity	September 1920 Value	Nine months ending September 1918 Quantity	Nine months ending September 1918 Value	Nine months ending September 1919 Quantity	Nine months ending September 1919 Value	Nine months ending September 1920 Quantity	Nine months ending September 1920 Value
Glass and glassware:										
Bottles, vials, demijohns, carboys, and jars, plain, ordinarily used as containers, empty or filled.....lbs. dut.	385,113	22,117	598,890	30,442	.....	86,954	1,185,196	65,223	4,403,072	207,522
Bottles, decanters, and other glassware, cut or ornamented .....dut.	.....	42,025	.....	150,880	.....	185,802	.....	286,776	.....	729,020
Optical instruments, including lenses and spectacles .....dut.	.....	43,994	.....	98,979	.....	109,879	.....	203,455	.....	645,616
Sheet and plate glass—										
Cylinder, crown, and common window glass, unpolished .....lbs. dut.	53,274	9,559	255,869	27,849	281,337	39,374	555,923	68,927	3,907,291	399,219
Plate glass, cast, polished, unsilvered. sq. ft. dut.	11	5	315,949	260,233	273	210	11	5	1,385,649	1,138,214
Plates or disks, rough-cut or unwrought, for optical purposes.....lbs. free.	40,602	25,349	70,747	76,902	.....	242,007	420,261	292,074	680,412	735,695
All other .....sq. ft. dut	.....	74,661	.....	259,703	.....	386,177	.....	427,526	.....	1,396,138
Total	.....	217,710	.....	904,988	.....	1,050,403	.....	1,353,986	.....	5,250,824

EXPORTS OF GLASS AND GLASSWARE.

Glass and glassware:										
Common window glass, boxes (50 sq. ft.).	70,289	$428,159	61,397	$383,522	531,575	$2,818,826	738,397	$5,045,238	461,552	$3,135,343
Exported to:										
France	1,176	7,013	.....	.....	.....	.....	208,499	1,668,334	94	698
Canada	42,516	222,902	31,401	171,198	311,822	1,444,931	126,375	681,698	234,165	1,447,698
Mexico	286	2,857	6,470	46,597	11,787	74,048	18,084	132,334	24,109	195,790
Cuba	1,568	9,004	6,577	55,804	23,566	131,837	12,441	91,935	28,628	211,587
Argentina	5,038	37,336	1,602	13,175	37,425	267,479	83,868	586,322	15,479	127,994
Brazil	2,708	21,511	4,244	26,785	17,660	100,686	53,287	340,518	27,461	194,704
Chile	2,026	12,069	400	3,391	40,845	242,934	25,549	171,864	11,235	68,345
Uruguay	.....	.....	868	4,843	.....	.....	.....	.....	4,933	31,247
China	.....	.....	816	8,679	.....	.....	.....	.....	23,150	158,859
Japan	4,361	39,250	3,920	14,135	4,204	28,725	9,484	98,757	19,759	158,590
Australia	2,242	14,451	.....	.....	38,091	230,318	97,336	587,771	9,737	75,732
New Zealand	1,253	8,190	.....	.....	3,170	17,150	24,873	139,793	3,055	23,630
Other countries	7,115	53,576	5,099	38,915	43,005	280,718	78,601	545,912	59,747	440,469
Cut or engraved glassware	.....	23,554	.....	38,770	.....	101,852	.....	177,012	.....	305,322
Plate glass, unsilvered .....sq. ft.	320,126	203,050	315,063	277,924	4,129,535	2,084,497	6,357,200	3,677,269	3,366,193	2,212,785
All other	.....	720,172	.....	1,088,789	.....	3,898,041	.....	6,032,175	.....	8,629,028
Total glass, etc.	.....	1,878,238	.....	2,703,987	.....	11,182,555	.....	18,808,989	.....	21,781,026

SHIPMENTS FROM THE UNITED STATES TO ALASKA.

Glass and glassware	.....	8,804	.....	11,975	.....	42,787	.....	48,721	.....	68,913

SHIPMENTS FROM THE UNITED STATES TO HAWAII.

Glass and glassware	.....	10,461	.....	37,322	.....	136,034	.....	172,156	.....	312,243

SHIPMENTS FROM THE UNITED STATES TO PORTO RICO.

Glass and glassware	.....	19,090	.....	50,733	.....	131,951	.....	155,000	.....	312,414

Current Prices of Glass-Making Materials

From quotations furnished by various manufacturers and dealers

November 28, 1920

	Carlots.	Less Carlots
Alumina-Hydrate .....lb.		.12 –.14
Antimony-Oxide .....lb.		.11 –.12
Arsenic Trioxide, Dense White, 99% .....lb.		.14
Barium Carbonate .....lb.		.05 –.06
Barium Hydrate .....lb.		.07½
Bone Ash .....lb.		.10½
Borax .....lb.		.09
Cadmium-Sulphide .....lb.		2.00 –2.50
Cobalt-Oxide .....bbl.	4.00 (10 lb. tins)	4.10 –4.25
Copper-Oxide, Red .....lb.		.50 –.55
Copper Oxide, Black.....lb.		.27 –.40
Feldspar .....lb.	.01¼–.01½ (X works)	.02 (N. Y.) .03 –.03½
Fluorspar		
Kryolite .....lb.		.15
Lead-Oxide (Red Lead Pb_3O_4) lb.	.10½	.11
Litharge (PbO) .....lb.	.10	.10½
Nickelic Oxide (NiO).....		.50
Manganese .....lb.		.04½–.10
Potassium Carbonate		.13
Potassium Nitrate		.14
Powdered Blue .....lb.		.35 –.40
Salt Cake .....ton	35.00	50.00
Selenium .....lb.		2.25 –2.50
Sodium Nitrate .....lb.		.03½–.07
Soda Ash—58% dense (f. o. b. Works, 1921 delivery, 48% basis), bags .....100 lbs.	1.95 –1.97½	2.05
Sulphur (Flowers) .....lb.		.04½
Uranium Oxide .....lb.		2.75 –3.50
Zinc Oxide (ZnO).....lb.		.12 –.18

Stock Quotations

(Reported by Moore, Leonard & Lynch, Frick Building, Pittsburgh, Pa.)

New York, November 27.

	Bid	Asked
Libbey Owens Sheet Glass, common.....	155	165
Libbey Owens Sheet Glass, preferred.....	104	109
Owens Bottle Machine, common.....	49½	49¾
Owens Bottle Machine, preferred.....	95	100

Pittsburgh Stock Exchange

Report of sales from November 20 to 27, inclusive.

Shares	High	Low	Last
817 Am. Window Glass Mch., common....	116	109	116
215 Am. Window Glass Mch., preferred...	86	85⅞	86
Am. Window Glass, preferred.....	100	100	100
55 Pittsburgh Plate Glass.....	145	145	145

United States Glass, 55 asked.

Wheeling Exchange, November 27.

	Bid	Asked	Last
Fostoria Glass Co.....	105	111	108½
Hazel-Atlas Glass Co.....	180	185	180½
Imperial Glass Co.....	90	95	91